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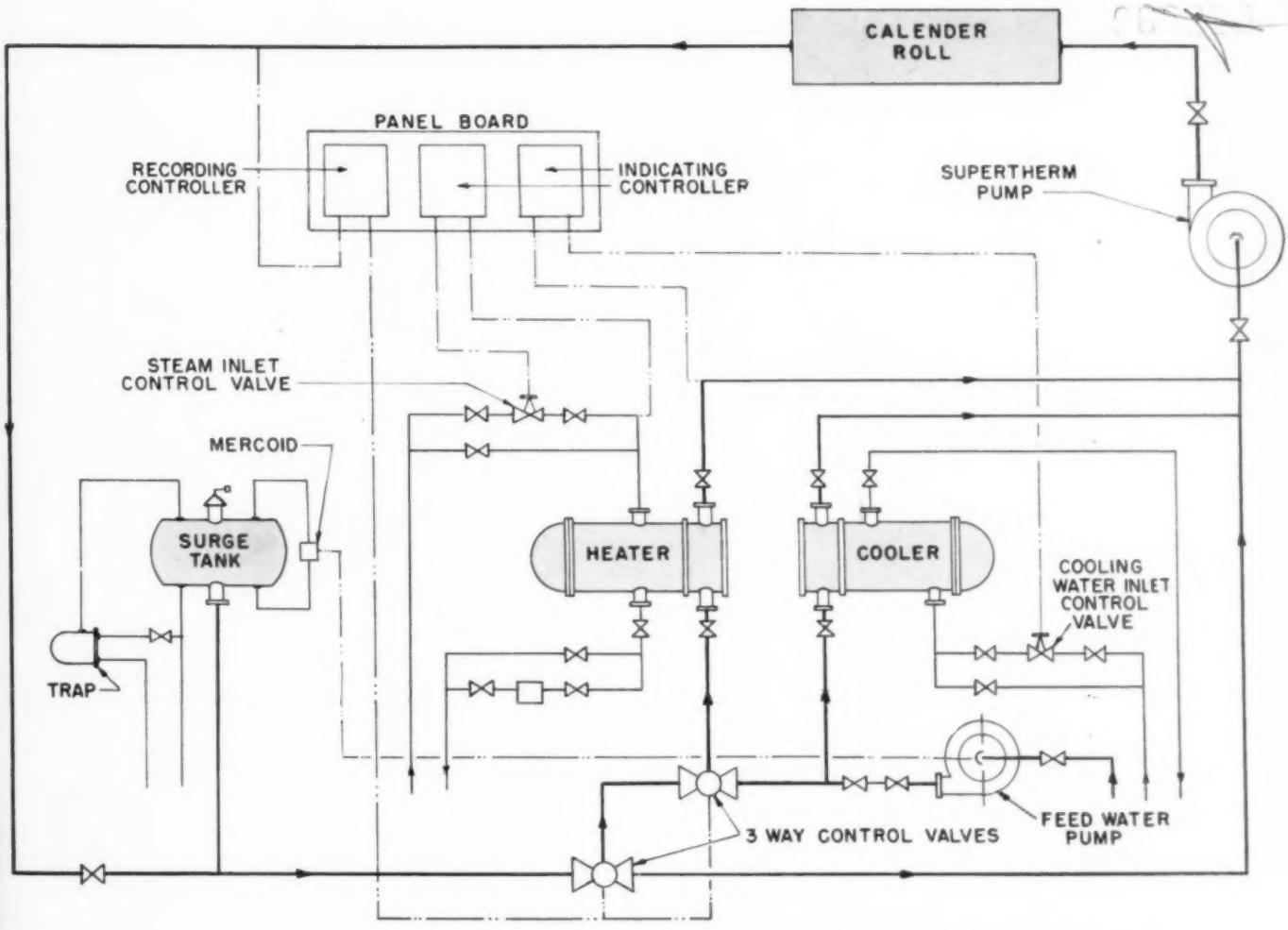
THE MAGAZINE OF APPLIED ENGINEERING



SCHEMATIC REPRESENTATION OF A TEMPERATURE CONTROL SYSTEM FOR THE CIRCULATING WATER USED TO ADJUST AND MAINTAIN ROLL TEMPERATURES OF A VINYL PROCESSING CALENDER

an article by G. T. Barks and M. W. Williams/page 480

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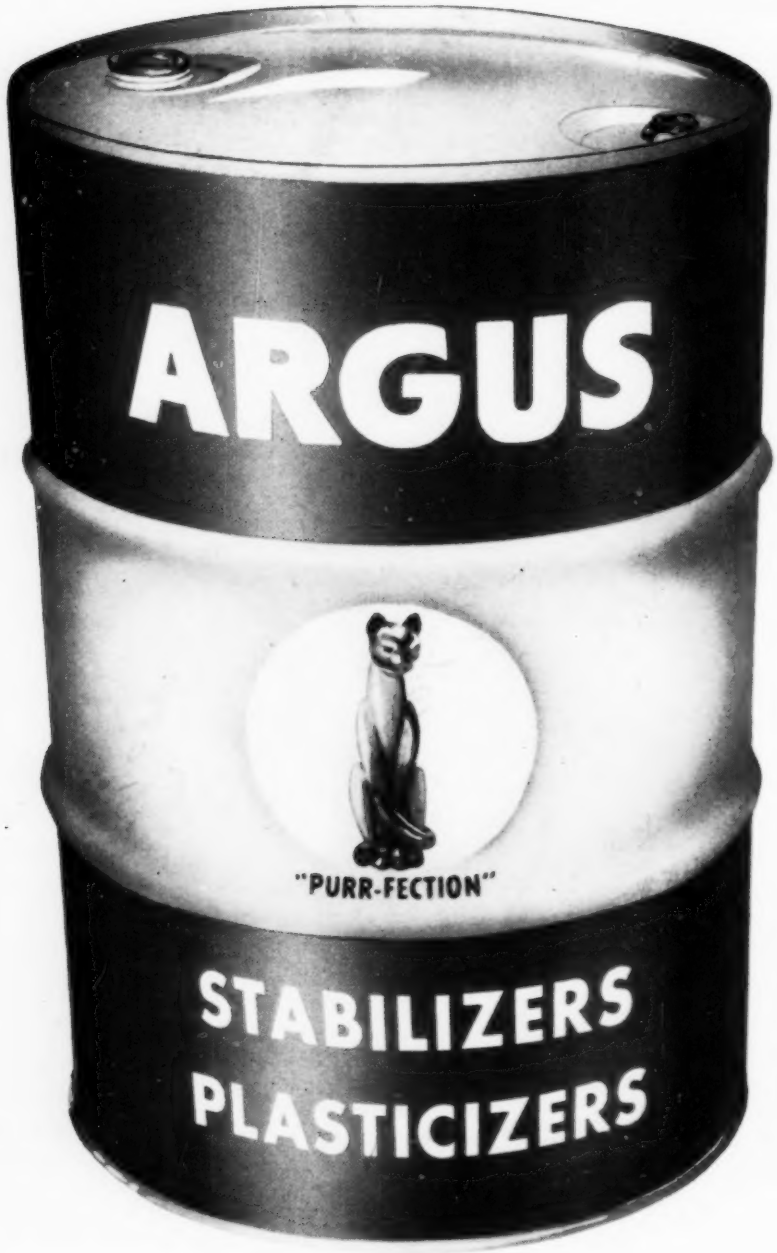

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LUSTREX
Styrene Plastic

How Monsanto's soft-flowing styrene is speeding production and cutting rejects

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MONSANTO

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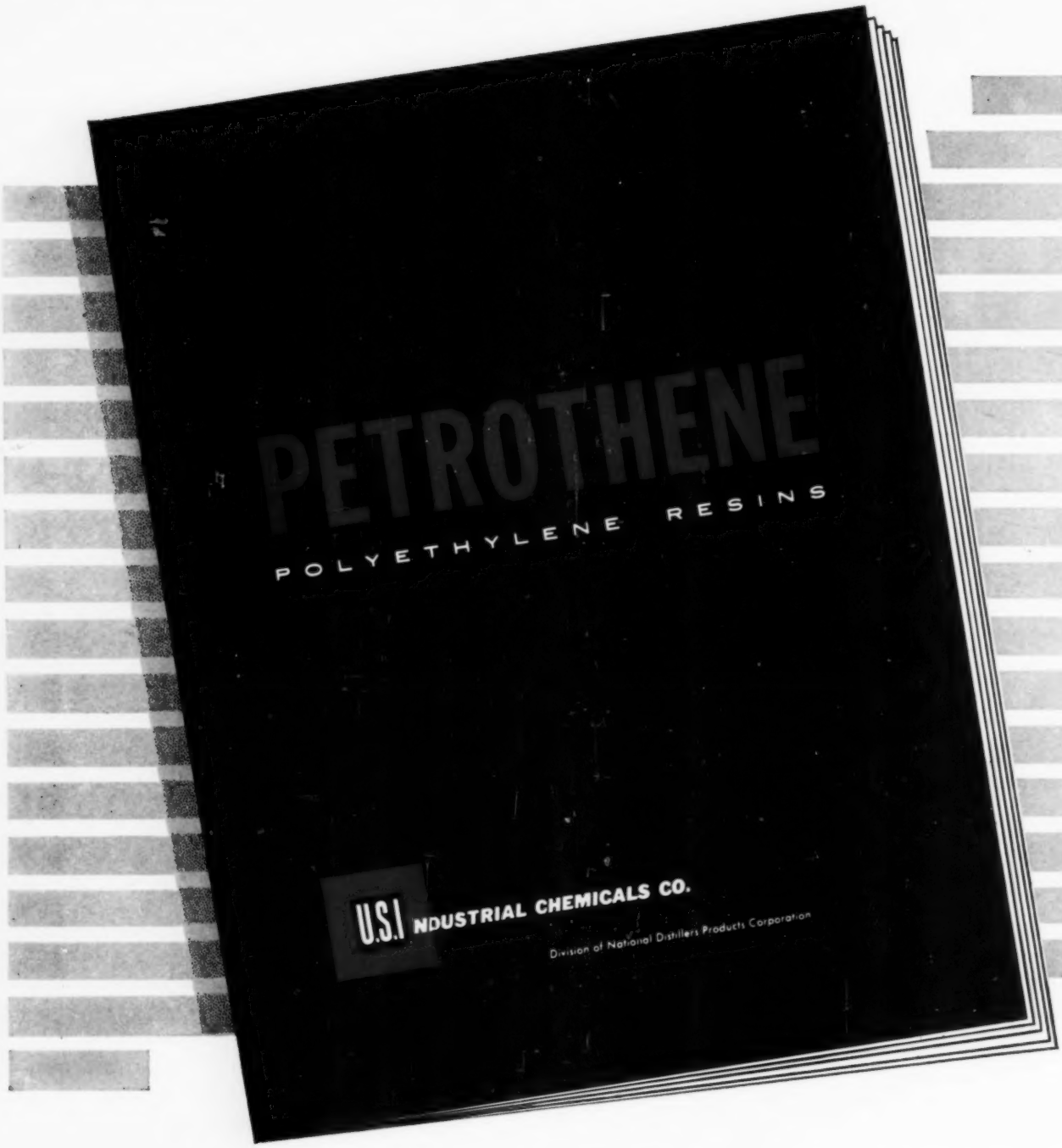

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SEPTEMBER 1955
VOLUME 1, NUMBER 8

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Chairman of Board and Treasurer, Raymond Bill. President, Edward Lyman Bill. Vice Presidents, B. Brittain Wilson, C. Ernest Lovejoy, Wm. H. McCleary. Editorial and Executive Offices, 386 Fourth Ave., New York 16, N. Y. LExington 2-1760. *Subscription Price:* United States and Possessions and Canada, $4.00 per year. All other countries, $8.00. Single copies in the U. S. 50¢; elsewhere, 75¢. *Other Bill Brothers Publications:* In Industry: Rubber World. In Marketing: Sales Management, Sales Meetings, Premium Practice. In Merchandising: Floor Covering Profits, Fountain & Fast Food, Grocer-Graphic, Tires-TBA Merchandising, Yankee Grocer.

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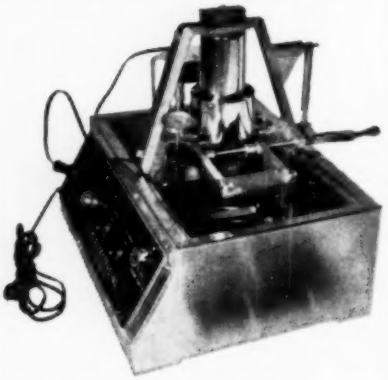

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Letters to the Editor

Dear Sir:

We have read with considerable interest your editorial in the August issue proposing the establishment of a national plastics institute. We respond to your invitation for comments inasmuch as your article strikes a very responsive chord since we have probably given more thought to this subject than anybody else interested in plastics.

As you know, we are offering the only graduate engineering curriculum in plastics of the type approved both by SPE and SPI. This is not only unique in American education, but in traveling in Europe two years ago I found nothing comparable there. I did, however, find the institute type of interest which you mention and which has occurred to me at various times during our first 10 years of operation. 1955 being our tenth anniversary.

In approaching various groups with the idea of obtaining general industrial support for our Laboratory here, we met with little encouragement. Thus, we remain a university educational project with our research supported entirely by government contract and by three or four industrial fellowships.

We do not know whether the time might be more appropriate now than formerly to interest the plastics industry generally in supporting such an institution as we have here. It is entirely probable that industry would protest university control of such a project. Otherwise, we have an experienced staff and an excellent physical set-up for precisely what you propose. If your suggestions are to develop into tangible results, we suggest that we be considered as a prospective nucleus for a plastics institute. Even in the event that this might not prove feasible, we strongly recommend that this particular location be considered for such an institute. Princeton is in itself quite a research center, and such an institute as you have in mind located here would be removed from the usual industrial turmoil in which it might be too easily influenced by special interest.

L. F. Rahm, Director
The Plastics Laboratory
Princeton University,
Princeton, N. J.

• • •

Dear Sir:

In the July issue's Letters to the Editor, a reader asks what can be done to increase the plasticizing capacity, clamping, injection pressure, and press speed of a 10-year old horizontal eight-ounce injection machine to make it more competitive with newer machines.

Although we cannot do directly what the inquirer wants to accomplish, we do feel that weigh feeding his molding presses would put him in a more competitive position.

We cannot increase the injection pressure, but by weigh feeding we can give more effective pressure in the die. This can be done because with weigh feeding there is less material needed in front of the plunger, meaning less pressure loss due to material friction in front of the plunger and, therefore, more effective pressure to fill the die.

The clamping force will become less critical when the injection machine is weigh-fed the material to the cylinder because excess material is not being forced into the die. A little press time may be gained because weigh feeding permits injection at full injection pressure.

Weigh feeding increases output by reducing the number of rejected parts. Rejections from molding presses sometimes run as high as 10-20%, and weigh feeding often can reduce this figure to less than one-half the original value. In addition, the molded parts will be more uniform in size.

We can present written case histories showing the savings and increased production obtained by customers using weigh feeding equipment.

J. E. Konkle, Advertising Mgr.
The Exact Weight Scale Co.
Columbus, Ohio

(This reply has been forwarded to the original inquirer, as has the reply by Morse, of Injection Molders Supply Co., which appears in the article section of this issue.—Editor)

• • •

Dear Sir:

We note a description of a new product designated Allfab, introduced by the Felters Co., in your May issue, item

P-9. This product is a textile-resin filler material.

Would you please forward us the address of this company or refer our inquiry on to them?

K. M. Holland,
Exec. Vice President
Hexcel Products Co.,
Oakland, Calif.

(The inquiry has been referred to Felters even though the Readers' Service Cards bound into the May issue have expired. —Editor)

• • •

Dear Sir:

For some time we have been interested in a plastic that could be poured at low temperature for either casting or molding small quantities of slightly intricate shapes. For example, we supply the Boy Scouts of America with neckerchief slides. The demand for a neckerchief slide varies considerably and quantities are never large; namely, in the neighborhood of 5,000-10,000 pieces. Inasmuch as it is desirable to keep the total cost of these pieces below 10¢, it is not practical for us to utilize any molding processes with which we are acquainted.

We would appreciate your advice and assistance in selecting a material that would be suitable for such objects, and which would not require highly specialized equipment.

Harry Buzby, President
Bee-Lyne, Inc., Broomall, Pa.

• • •

Dear Sir:

In your July issue, page 350, you very kindly refer to a product made by our company. We appreciate this mention, but it would be a little difficult for any potential customer to contact us in that you use Evanston, Ind., for our address which should be Evansville, Ind.

Any action you can take to correct this situation will be appreciated.

J. R. Davidson, Sales Manager,
Cardinal Division,
Hoosier Cardinal Corp.,
Evansville, Ind.

(We apologize for the error in address. Any inquiries received on the product will, of course, be referred to Hoosier Cardinal at Evansville.—Editor.)

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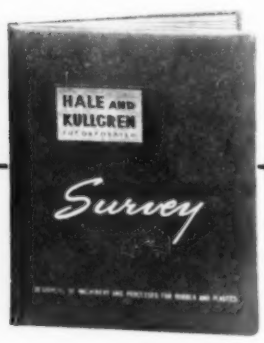


Program for Profits

Dear Sir:

We have been reading the August edition of your journal, and notice that you publish abstracts of important articles.

It has occurred to us that possibly many of your readers may be interested in receiving copies of technical reports that we issue. As no doubt you are aware, we have a very large vacuum coating laboratory, and technical reports are published frequently by our staff.

F. J. Pearce, Director & Gen. Mgr.
W. Edwards & Co. (Canada), Ltd.
Toronto, Ont., Canada

(We are very interested in receiving these reports. Since our Abstracts department is taken directly from magazines here and abroad, the reports will be mentioned and described in our New Literature department which covers publications available to our readers.—Editor.)

• • •

Dear Sir:

Your editorial (August issue) pointing out the need for a national plastics institute is well taken. Such an institute could well operate as a division of the Society of the Plastics Industry, but would devote itself to actual technical work with a full-time staff of plastics chemists and engineers.

Similar institutes exist in other countries and do excellent work for the entire industry.

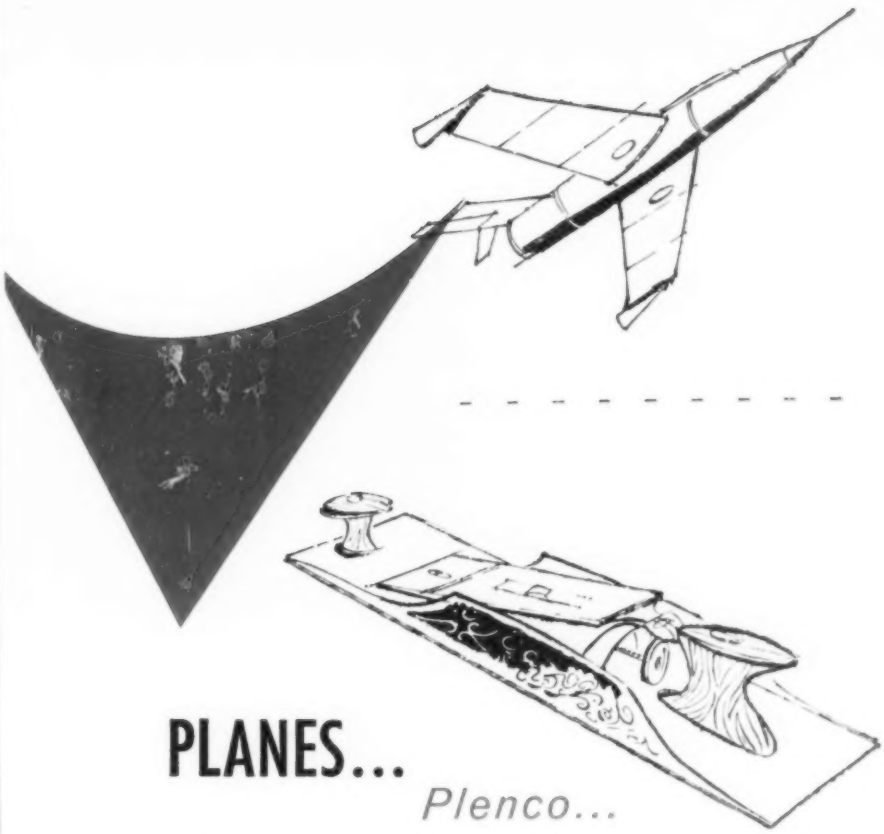
There is perhaps one additional objective which such an institute could serve; to be a training ground for future industrial plastics technicians.

Peter H. Seckel
Anchor Plastics Co., Inc.
Long Island City, N. Y.

• • •

(Continued on page 499)

We invite letters from our readers for publication in these columns. Such letters may be of comment or criticism, requests for information, or of general interest. The only requirement is that all letters must be fully identified as to name of sender, company affiliation, and address. . .Letters requesting information on technical or engineering problems will be printed to elicit replies by the readers, either directly or through these columns. Upon request the identities of such "problem" letters will not be divulged.
—The Editor



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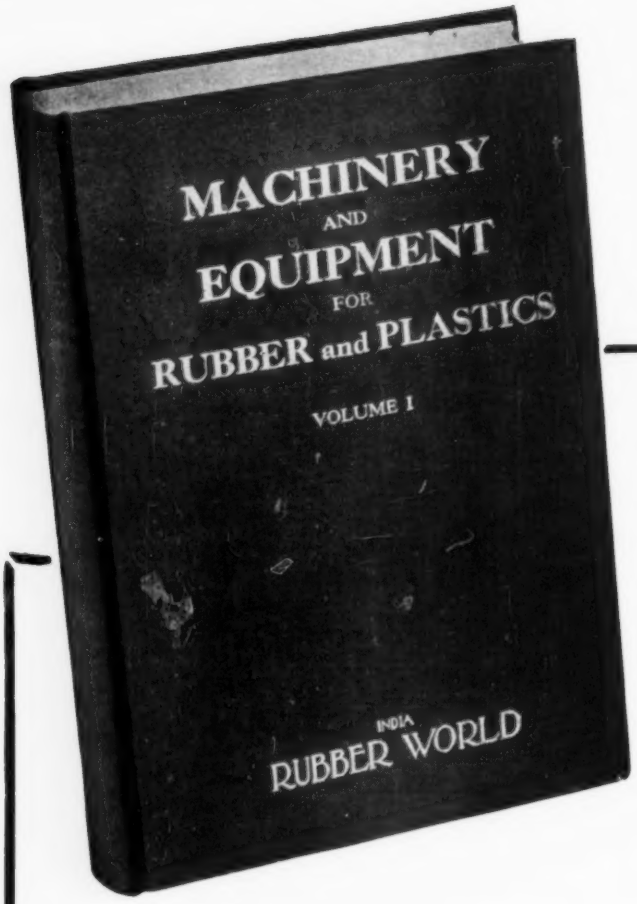

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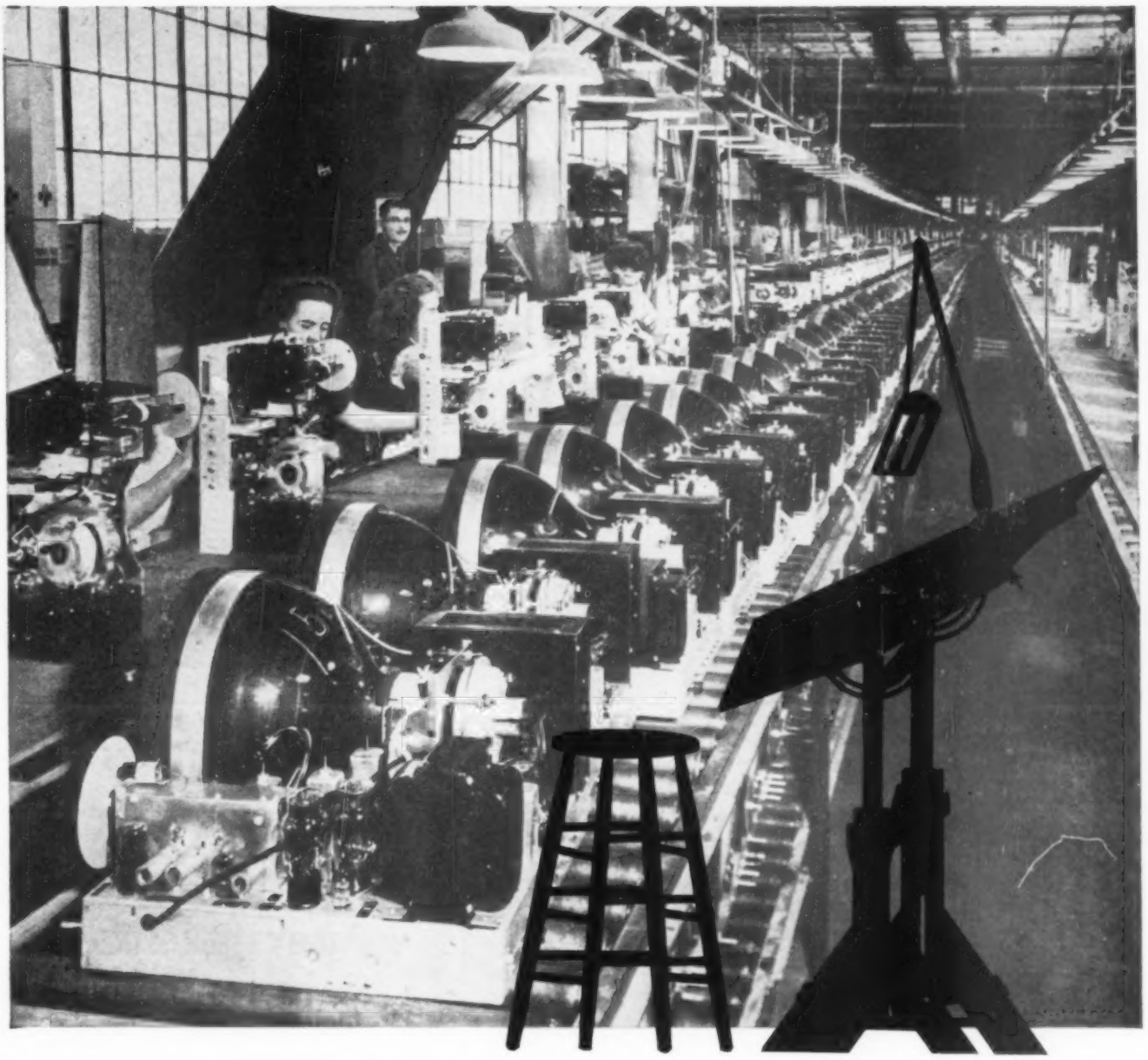

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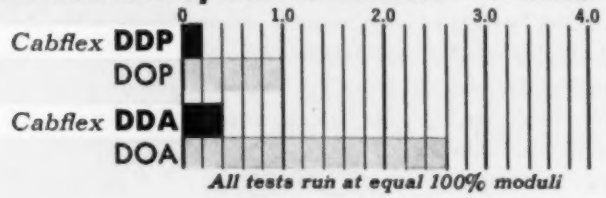
EXTRACTION by SOAPY WATER — % LOSS



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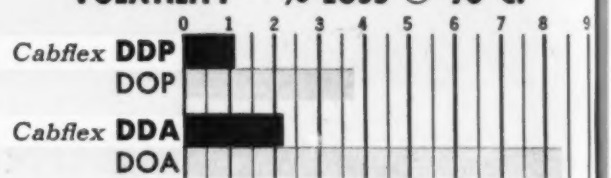

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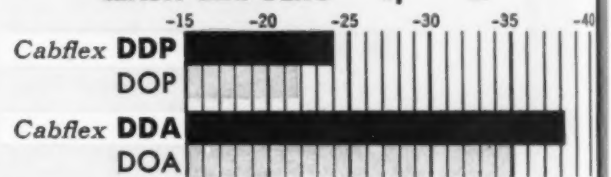

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NEWS in BRIEF

The West Coast will play a big role in chemical and plastics processing, according to J. L. Gillis, Monsanto vice president. Nearly every major chemical manufacturer has at least one plant in California, and petrochemical production is on the increase. Chemical industry employment shows a 20% gain over the past four years. During this period of time, Monsanto has invested about $10 million for expansion in California alone.

Modernizing of old injection machines to make them competitive with newer units is a subject of great interest to all injection molders. Studied suggestions for increasing the plasticizing capacity, clamping, injection pressure, and press speed of these older machines are given by A. R. Morse, of Injection Molders Supply Co. (see page 478).

Savings in die costs of up to 50% have been obtained by Teicher Mfg. Co., Flushing, N. Y., which is using cast epoxy resins, instead of lead and kirksite, to make drop hammer dies. The savings come in lower material costs for the plastic dies, greater speed in making and renovating the tools, elimination of shrinkage, and reduction of finishing time.

Reinforced plastic boats of moderate size can be built successfully to give better service than boats made of other materials, according to Anchorage Plastics. The company is making a 29-foot fiberglass-reinforced polyester plastic boat on a production basis.

Corporate changes in the plastics industry during the month included the purchase of Industrial Synthetics and its Supplex subsidiary by American Hard Rubber. Bolta-Carpart was purchased by a group of industrialists, and will operate as Mitchell Plastics. The Thermacote companies have merged and become a subsidiary of Holiday Plastics. A new company, Robinson Collo, has been set up in Canada to produce polyurethane foams.

Polyethylene resins made by U. S. Industrial Chemicals have had their grade numbers realigned, and are now available in three series.

Company expansions in plastics continued to be announced thick and fast. Baker Brothers will build larger facilities at Toledo, O., for its plastics press division. Battelle will construct a new $1.4 million chemistry building. Durez opened its new $5 million plant at Kenton, O. An expansion that will double its production, engineering facilities, and office space will be built by Falls Engineering & Machine. New additions to its extrusion plant are planned by Jet Specialty Sales. A new phenolic resins plant was opened by Reichhold Chemicals in Kansas City, Mo. Rohm & Haas has built a new plastics plant at Gardena, Calif. Union Carbide & Carbon will erect a 41-story building, one block square, in New York City to house its offices and those of its divisions and subsidiaries.

New Materials worthy of mention this month (see page 510): a polymeric vinyl plasticizer; silicone anti-foam emulsions; a heat-resistant polyester insulation for magnet wire; vinyl stabilizers, brighteners, and lubricant; vinyl plastisols for sponge-making; two vinyl plasticizers; and a polyester laminating resin.

New Equipment in the news (see page 512): a vertical hydraulic press; a laboratory aging block; an extrusion cutter; vacuum metallizers for roll materials; a vacuum-packaging machine; a temperature control unit for calendering; and a 12-16 ounce injection machine.

New Products of interest (see page 514): a molded urea housing for a TV antenna rotator; electrical-insulating reinforced plastic clamps; an acrylic bug deflector with built-in speedometer for autos; reinforced plastic trays for conveyor belts; an air-porous vinyl upholstery foam; patterned melamine dinnerware; a styrene match-dispenser; white polyethylene pipe fittings; and a vinyl film treated for photographic reproduction.

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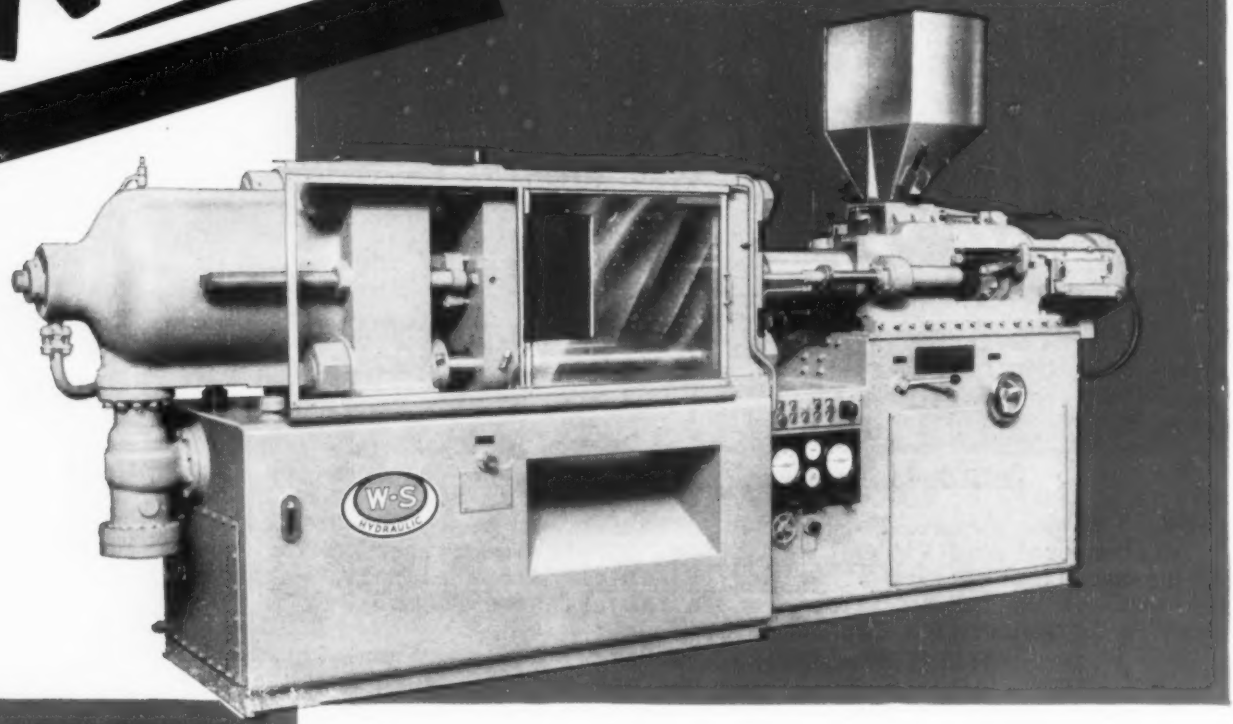

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3226

PLASTICS TECHNOLOGY

SEPTEMBER, 1955

EDITORIAL: The Proposed National Plastics Institute

In our editorial last month, we proposed the establishment of a National Plastics Institute. We expressed the belief that support for the Institute should not be restricted to any one segment or group, but should come from the entire domestic plastics industry. The information to be obtained by the institute in its work would provide the necessary basic engineering data on plastics that would serve as the impetus for the expansion of these materials into engineering applications. These applications are almost limitless, and their utilization of plastics would be of direct benefit to every company and individual in plastics.

Of course, it is apparent that some types of plastics companies, such as the materials suppliers, would benefit from the Institute's work to a greater extent than other firms. Accordingly, these companies should be expected to make a greater contribution to financial support of the Institute.

•

General consideration of the financial support mechanism for the Institute leads to the conclusion that company support should be on a sliding scale with twin yardsticks: (1) the type of work in which a company is engaged; and (2) the relative size of the company in its specific field of activity.

In addition to the plastics companies, financial support of the Institute should also come from the MCA, SPI, SPE, ASTM, and other organizations and societies engaged in plastics work. It should be recognized, however, that these organizations also have a stake in the professional advancement of plastics. Because of their more impartial interest in plastics, they could well play important roles in directing the Institute. In fact, we suggest that the Institute's administrative group be composed largely of representatives of these various organizations and societies.

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Choosing the physical location of the proposed Institute is a matter that would require careful consideration in order to avoid any implication of subjection to normal industrial turmoil or subservience to influence by any special interests.

To avoid the needless expense of building a completely new facility, the Institute could be located at an existing university or other research center that is willing to partake in plastics work of this nature, and already has an adequate nucleus of staff, equipment, and space for the work. Since the industry would probably object to the university or research center having full control of the Institute, the university or center selected could be given proportional representation on the Institute's board of governors or administrators and thus, play an appropriate role in guiding the work of the proposed Institute.

Arthur M. Merrill

Editor

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Welding and Powder Spraying of Plastics*

Advantages, operation, and applications of two fabricating techniques applicable to thermoplastics.

J. A. NEUMANN, *President & Research Director*
American Agile Corp., Bedford, Ohio

Two fields have rapidly developed in the plastics industry during recent years; plastic welding and powder spraying.

The first experimental welding in the United States was performed by R. C. Reinhardt, of Dow Chemical Corp., whose initial welding gun was patented in 1937. Plastics welding has advanced as a standard method of fabrication to the extent that today there are at least 1,000 welding guns in operation in this country.

Thermoplastics which produce a weld strength of 75% or more of the tensile strength of the parent material may be classified as weldable materials. Some of these are polyethylene, polyvinyl chloride, polystyrene, polyvinylidene chloride, and polymethylmethacrylate.

The number of applications for powder spraying of thermoplastics has increased markedly. Polyethylene coatings are used primarily where maximum corrosion resistance is required in conjunction with flexibility and abrasion resistance.

Hot-Gas Welding

In many respects, hot-gas welding of plastics resembles the gas welding of metals, and presents little difficulty to those familiar with metal welding. Similarities exist in the necessity of even heat supply to the welding zone, the shape and applications of welding guns, the use of spline (welding rod), the preparation of the seam, and the wide variety of shapes and cross-sections which may be joined.

Since gas-heated torches are independent of electrical supply systems, they are somewhat more flexible in field use. When working on roofs or in inaccessible spaces, gas-heated torches offer the additional advantage of short leads, since the equipment is self-contained. Electrically-heated torches, because of their lighter weight, are often preferred where fatigue must be minimized.

Julius A. Neumann was born in Czechoslovakia, and was educated in that country and in Germany, receiving a PhD in engineering from the University of Berlin. He served as research engineer for Agile Corp., until 1927, at which time he published the first book about electrical welding. From 1932-1940 he served as director of research for International Welding Co., and Arc Mfg. Co., Ltd., both of London, England.

Mr. Neumann founded American Agile Corp., in 1940, and has served as president and director of research since 1942. The firm has been actively engaged in the plastics field since 1948, and in 1954 Mr. Neumann published the "Manual for Plastic Welding" Vol. II, Polyethylene. He is active in SPE, SPI, AWS, and ACS.

To avoid surface oxidation when welding with polyethylene, an inert gas, such as nitrogen or carbon dioxide normally is used. Air is used in welding polyvinyl chloride, however, since some oxidation appears beneficial.

In practice, the gas emerges from the torch nozzle in the temperature range of 500-60° F. About 200° F. are lost between the tip of the gun and the welding zone.

* Based on a paper presented at the Eleventh Annual National Technical Conference, Society of Plastics Engineers, Inc., Atlantic City, N. J., Jan. 21, 1955.

Fig. 1. Corner welding technique on polyethylene

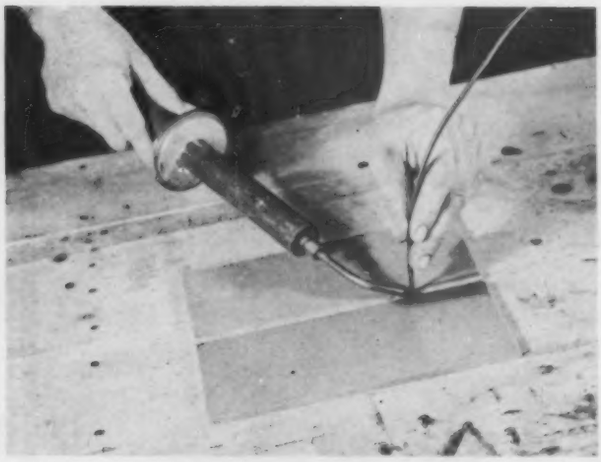


Fig. 2. Butt welding of rigid polyvinyl chloride

Fig. 3. Welded polyethylene weather cap (diameter, two feet)

The required temperature varies with the type and thickness of material, and may be regulated by adjusting the rate of flow of gas which is supplied at a pressure of approximately 5-15 pounds per square inch. To facilitate variations in heat concentration, different size tips are offered for most torches and can be interchanged as required.

For optimum performance and maximum homogeneity of the weld, the composition of the filler rod should be the same as that of the parent material. This insures identical softening ranges and minimizes danger of overheating one or the other member of the joint. Nevertheless, in some cases a plasticized spline improves weldability and mechanical properties of the weld. The plasticized weld, however, is more vulnerable to attack by corrosive agents.

Another important factor in good welding is the size of spline. Splines exceeding 3/16 inch in diameter present difficulties in uniform heating and ready control.

The main difference between and welding of metals and that of thermoplastics is the fact that bonding in thermoplastics welding takes place only at the fused surfaces. The core of the plastics welding spline remains rigid. Since the softening range of most thermoplastics is rather narrow, it is important that the recommended technique be followed accurately to insure optimum results.

Weld preparation is similar to preparation for metal welding. All types of welds, such as corner welds (see Figure 1), fillet welds, butt welds (see Figure 2), and lap welds can be made readily. Sheet beveling may be done with joiners, belt sanders, or hand shapers, or other appropriate beveling instruments.

The spline or filler rod is held at aprroximately 90° and the torch at about 45° to the welding surface. Surfaces and edges to be joined are preheated together with the spline by imparting a slight oscillating movement to the torch nozzle. Within a short time, the parent plastic and surface of the spline soften and, while the torch is slightly withdrawn, the spline is pressed firmly into the softened material. Poor bonding results from insufficient preheating. Over-heating, on the other hand, causes blisters and darkening of the material. Since a slight crown increases the strength of welds, dressing the weld is not recommended unless a smooth surface is an absolute requirement.

With polyethylene, butt joints reach nearly 100% of the parent-material strength. The strength of fillet welds is slightly lower than the strength of butt welds.

One of the outstanding advantages of hot-gas welding is the ease of fabrication of irregular shapes by welding. Welds of heavier material may require the use of several beads which are all layed with the same technique.

The speed of welding should be kept at 5-8 inches per minute, depending on the type and thickness of the parent plastic, to prevent overheating or improper fusion. Since hot-gas welded joints do not attain their full strength immediately after welding, a few hours should elapse before the application of stress.

Wherever large or special shapes of plastic fabrications are desired (see Figure 3), plastic welding is the economical solution. Two thermo-plastics polyethylene and polyvinyl chloride, deserve special attention be-

cause of their wide scope of applications. Such items as vats, buckets, jugs, pipe lines, and fume ducts (see Figure 4) are fabricated by plastic-welding processes, and have successfully handled hydrofluoric, sulfuric, and nitric acids, strong alkalies, brine solutions, and other corrosive media. Similar applications include tank linings, pipe fittings, and various forms of etching and bleaching equipment (see Figure 5).

Powder Spraying

Powder spraying of thermoplastic materials is a very successful method for coating surfaces subjected to corrosive chemicals, moisture, or abrasion. It is also used where electrical insulation is required. Polyethylene, polyethylene-polyisobutylene blends, cellulose acetate, and polyamides have given promising results when powder sprayed.

The adhesion of powder-sprayed polyethylene to metallic surfaces depends to a large extent on the cleanliness of the surface to be coated. In small areas, the metal can be prepared with an emery disk. Larger areas should be sand- or shot-blasted. After cleaning, the surface should be preheated. With smaller pieces, this can be done in an oven at a temperature of about 400° F. Preheating can also be done with the powder-spraying gun adjusted to produce a neutral flame about three inches long.

The spray powder is placed in a funnel-shaped receptacle which is agitated by an air-driven vibrator. The powder particles then are carried by air to a cloud chamber in the top of the powder-supply unit. The cloud chamber is transparent, permitting the operator to observe the air-powder mixture and make appropriate adjustments. From the cloud chamber, the powder and air are drawn by suction through a flexible hose to the gun which projects it through the flame to the surface to be coated (see Figure 6).

By closing a by-pass in the gun, the amount of air fed to the flame can be reduced and the flame lengthened. This air adjustment should be made so that the length of the flame becomes about 24 inches. The temperature of the longer flame will be markedly lower than that used for preheating. Another function of the by-pass adjustment is to create a venturi effect above the flexible hose connecting the gun to the cloud chamber.

The powder partially melts on its way through the flame to the target, and complete melting results when it hits the preheated surface. Spraying is accomplished by moving the gun either horizontally or vertically across the target, whichever direction is conducive to good coverage.

The thickness of the sprayed polyethylene coating depends on the powder supply, the flame temperature, and the hand movement of the gun. It is advisable to make the spraying path approximately two inches wide. Immediately upon completion of one pass, overlaps are made until the desired thickness is reached. Employing this technique, a coating thickness of 1/32 inch can be achieved with two passes. The coating can be built up easily to thickness as great as 1/8 inch.

The heat supplied must be such that the powder melts upon striking the target, and fuses to produce a

(Continued on page 498)

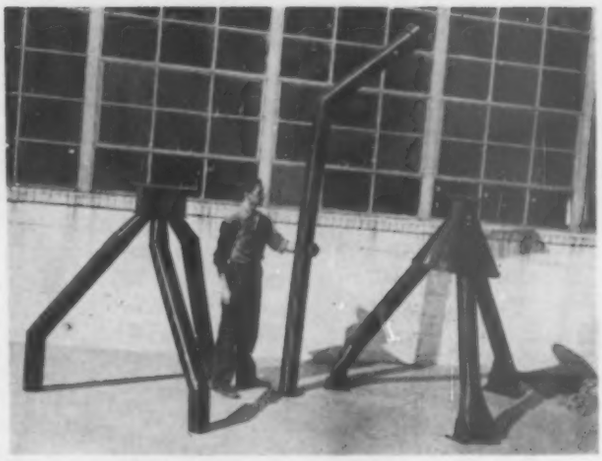


Fig. 4. Welded exhaust system manifolds of rigid PVC

Fig. 5. Welded tank of 3/8-inch thick rigid PVC. Tank is 50 by 35 by 30 inches, and used for hydrochloric acid rinsing

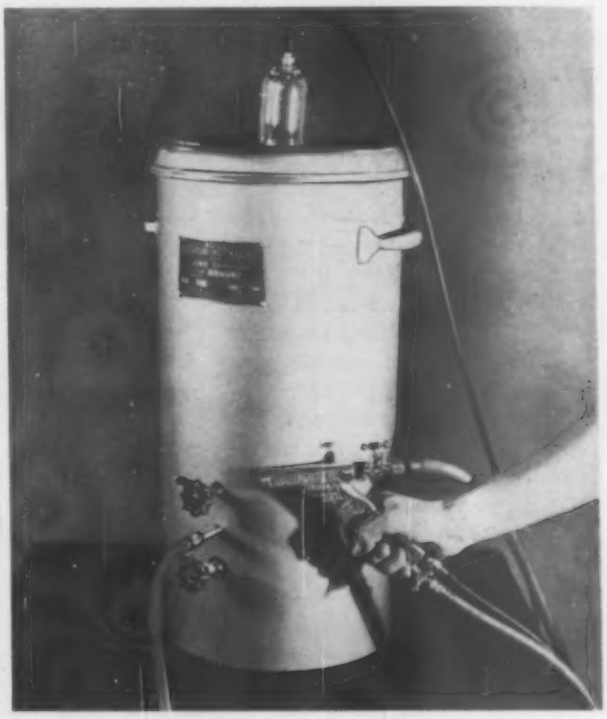
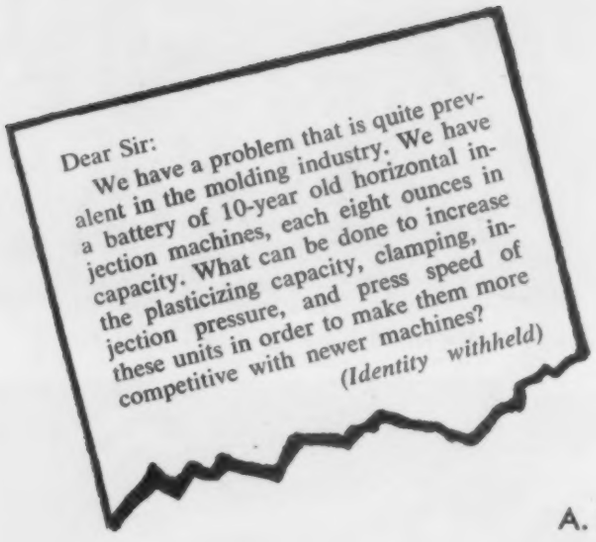


Fig. 6. Polyethylene power spray unit showing hopper, material and supply hoses, gun, and control valve


Dear Sir:
We have a problem that is quite prevalent in the molding industry. We have a battery of 10-year old horizontal injection machines, each eight ounces in capacity. What can be done to increase the plasticizing capacity, clamping, injection pressure, and press speed of these units in order to make them more competitive with newer machines?
(Identity withheld)

Modernizing Old Injection Machines

A. R. Morse replies to a reader's request, "How can I make my old equipment competitive with modern machines?"

Dear Sir:

In reply to the request for information on modernizing old injection machines, we have done a great deal of work on this problem because more presses were produced during 1944-46 than in any other period in our history.

A stopwatch analysis of the older injection machine cycle reveals that the clamping time is typically two seconds open and two seconds closed on the mechanical type press, and somewhat longer on the full hydraulic unit, depending on the top pressure setting. The injection time of the mechanical clamp machine requires approximately 8-10 seconds, and the plunger return time about the same. Although the plunger return may be faster somewhat on the hydraulic clamp machine, the injection stroke under pressure is somewhat slower.

We can safely estimate, therefore, that the best complete cycle on an older 8-12 ounce machine is 20-22 seconds. A plunger advanced to return the plunger halfway during mold closed time cuts 3-4 seconds off this cycle, and this easily-made modernization is to be highly recommended, of course. We have the following suggestions to make on reducing the remaining 17-18 second full automatic cycle where the injection stroke is consuming 13-14 of these valuable cycle seconds:

(1) A general overhaul is recommended, with installation of new pump rings, packings, and gaskets. Pump settings should be increased to 1,200 pounds on the high-pressure side, and 600 pounds on the low-pressure side. Dan MacFadden, of Michigan Plastic Products, has proved that use of a vacuum gage on the pump intake line can indicate clogged filters, and that cycles up to two seconds faster can be obtained when the vacuum is right (five inches or less on the intake side) than when restricted intakes or partly clogged filters give readings of 10-15 inches vacuum. We introduced these gages at his suggestion because it seemed like a clear-cut way to pick up several hours of press time per week but, in general, molders have not perceived their advantage nor bothered to investigate their time and money losses when pump intakes are not starved. Installation of a separate intake for the high-pressure pump, instead of bleeding it off the low-pressure intake line, will pick up as much as one second per cycle; a considerable gain achieved at the small cost of a few feet of piping.

(2) The oil should be changed from a DTE light grade to a DTE medium or even heavy type because the press will run hotter and the heavier oil grades will thin out to the old specification at the higher pump settings that give greater press speeds, etc.

(3) Bushings and pins should be removed from the toggle clamp, over-size bushings installed, and broken pins replaced. On full hydraulic presses, additional

(In the Letters to the Editor column of our July issue, page 233, a reader asked what can be done to increase the plasticizing capacity, clamping, injection pressure, and press speed of a battery of 10-year old horizontal eight-ounce presses (see duplicate of letter above) so as to make them more competitive with newer injection machines. The following is a letter from A. R. Morse, of Injection Molders Supply Co., giving his recommendations for modernizing the old machines. Another letter, from Exact Weight Scale Co., appears in the Letters column of this issue. Both replies have been forwarded to the original inquirer.—Editor)

holding pumps have been used successfully to increase clamping capacity and, of course, help out on ram travel.

(4) In some cases, additional 8-10 hp. pump sets are added to the circuit. These usually are standard Vickers units piped right into the present system and set behind the press. They occupy about two by four feet of floor space, and cost from $500-2,000. We have also experimented with accumulators, but results do not equal those obtained with extra pump sets because (a) there is a pressure drop with the accumulator which is objectionable because more, not less, pressure and speed are needed for faster injection strokes; and (b) cycles now are so fast that there is very little time available for existing pumps to work at high pressure to fill the boosters or accumulators. Where cycles of 10-15 seconds are desired on eight-ounce machines, the gas-type booster gets little or no time to charge up, whereas the pump set is always ready with a fixed volume of oil at a fixed pressure.

(5) In order to accommodate the added pump capacity and operate at the higher pressures and speeds, we suggest the addition of an over-sized oil cooler to the older press circuit. Either Ross or Young coolers can be used successfully, and we have gone so far as to stock such coolers for this purpose. In a few instances, the use of refrigeration to keep the oil cool and heavy-bodied has picked up 2-3 seconds per cycle by reducing internal oil leakage. Press response sometimes is outstanding, especially when wear and old age have resulted in loose pistons, etc., and it is cheaper and easier to super-cool the oil than to renew the internal parts of the hydraulic circuit. The use of additives to thicken the oil has not proved successful.

(6) We recommend installation of by-pass piping on the injection cylinder to carry the oil from the front side of the piston to the rear so that only a small amount of new oil need be added to push the injection plunger. This is an accepted hydraulic design feature that results in considerably faster piston travel without increasing pump capacity, and which any good maintenance man can install with some pipe and fittings. Vickers engineers on the check valves and Aeroquip Corp. engineers on the necessary hose and couplings can be very helpful here. Direct flexible hoses of larger capacity than the original equipment tubing have helped greatly in picking up a few seconds on the injection end which sometimes had restrictions in the various telescope tubes.

(7) We have sometimes suggested use of a second booster timer when the die platen is moving to eliminate up to one second per cycle without causing undue motor heating. Moving the present booster switch from the injection end to the clamp end is also suggested as this eliminates one microswitch from the injection end and gives double duty from the clamp-end switch which starts the plunger forward. The added speed here is often from 1-2 seconds. Sometimes a 10-15 second booster timer must be substituted for an old five-second timer, but the added speed makes the change very worth while.

(8) We have recommended the installation of standard over-size heaters (see photograph) to increase the plasticizing capacities of older presses. we stock these heaters in three sizes. For the Reed-Prentice eight-ounce press, for example, we offer an eight-inch diameter, 11,000-watt heater at $1,095; a 9¼-inch diameter, 14,000-watt heater at $1,795; and a 10½-inch diameter, 17000-watt heater at $1,995. These over-size units provide plasticizing capacities up to more than three times those of the original heaters. Both new contactors or relays and heavier fuses and wiring must be used with these over-sized heaters. Cylinders for other presses are available on order, and the improvement in plasticizing capacity that can be obtained varies greatly with the make and model of press, plunger

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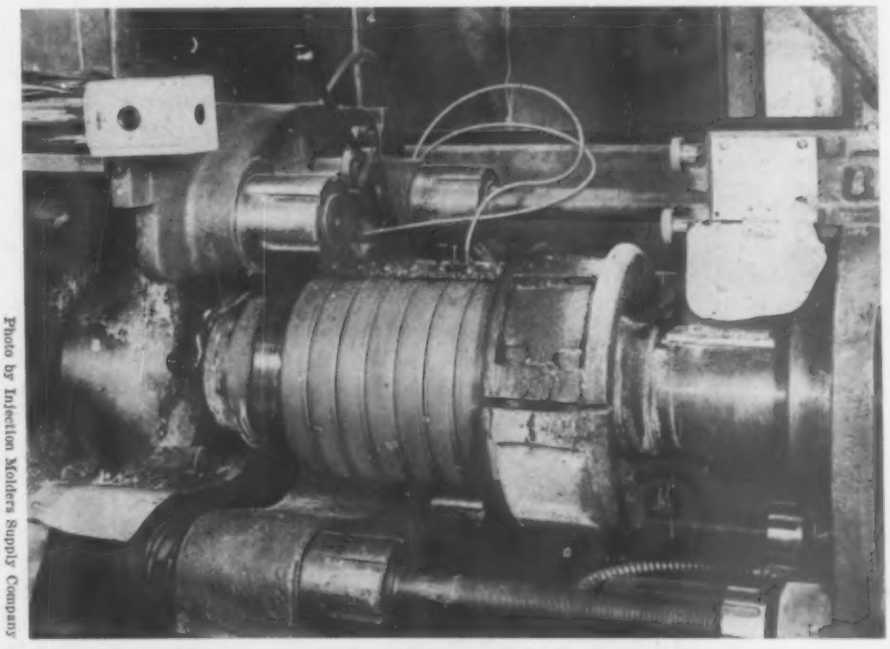

Photo by Injection Molders Supply Company

IMS Jumbo 17,000-watt replacement heater used to treble plasticizing capacity of a 12-year old Reed-Prentice eight-ounce injection press

Charles DuBois Hodges

G. T. BARKS, *Assistant to Sales Manager, Opalon, vinyl resins and compounds*

and

M. W. WILLIAMS, *Technical Service Representative, Opalon, vinyl resins and compounds*

Monsanto Chemical Company, Plastics Division, Springfield, Mass.

Vinyl Calendering and Plastisol Technology

Calendering and plastisol coating methods are compared with respect to operations, equipment, advantages, and applications.

The development of the technology of vinyl film, sheeting, and coated fabric manufacture has been rapid. It has had to be, to keep pace with the growth of an industry which was in its beginnings at the start of World War II, and now produces over 250,000,000 pounds annually of finished products. In its initial phase, the industry depended almost completely on equipment and practices developed in the rubber industry. Technologically, the industry today stands on its own feet, using equipment, techniques, and materials that have been developed for vinyls, although many interesting parallels with rubber practice are still evident.

Diversity in the range of products is immediately apparent. Vinyl film raincoats and curtains are familiar to us all, but industrial and agricultural uses such as electrical tape or silo covers are becoming increasingly important. Vinyl sheeting is used in such products as suitcases, handbags, and dinette sets. The wide range of decorative possibilities that can be obtained with different combinations of color, printing, and surface embossing is an important factor in the use of vinyl sheeting, along with its toughness and durability. Vinyl coated fabrics are used in similar applications when even greater wear resistance is desirable, such as is the case with automobile upholstery.

To make these products, the basic raw material used, of course, is polyvinyl chloride resin. Finished articles made solely of this thermoplastic material are hard, tough, and hornlike; like high fidelity, long-playing records. To obtain a supple and flexible product, plasticizers are used; normally 40-50 parts of plasticizer are used per 100 parts of resin for film, and somewhat more in sheeting and coated fabric. It is interesting to note that the vinyl compounder, like the rubber compounder, prefers to write his formulations based on parts per hundred of resin. Other ingredients which are used include stabilizers, pigments, lubricants, and fillers.

While each of these ingredients plays an important part in contributing to the properties of finished vinyl film and sheeting, the plasticizers selected are as important to the quality of the finished product as the resin itself. The types and amounts of the plasticizers employed will largely govern such important finished product properties as low temperature flexibility, flame retardancy, permanence of original properties and flexibility, resistance to migration and extraction, and compound cost. They also play a part in the hand and drape of the goods, and effect ease of processing.

In practice, it is customary to use combinations of plasticizers to secure specific end-product properties, balancing economics and performance factors. The subject of proper selection of plasticizer combinations has been well covered in the literature, but nonetheless is so broad as to cause never-ending study by compounders.

The calendering process is the predominantly important method in this country for manufacture of vinyl film, sheeting, and coated fabric, with important competition from the plastisol method in the latter product. Extrusion of film and sheeting is possible, but presents a number of practical difficulties. Interest in this process has largely centered abroad where it appears more attractive because of the lower capital investment required (as compared with calendering), and the fact that available on-the-spot equipment can be used for the process.

Calendering Process

The calendering process may be broken down into four basic operations: premixing of ingredients; final mixing and fusion; calendering; calender take-off, and final handling (including embossing, wind-up, etc.). A typical calendering process is illustrated schematically in Figure 1.

Premixing

The premixing operation starts with the weighing out of the half-dozen or more ingredients used in a calendering formulation, with the exception of pigment which is discussed below. The batch size can correspond to the amount to be charged to the Banbury mixer, for example, or it may be larger, master-batch quantity. The latter is preferable, since the effects of minor weight variations in individual ingredients are minimized. Basically, the purpose of premixing is to insure a material of uniform composition. The premixed product at this point may be said to physically resemble moist sand.

Satisfactory premixing may be accomplished in many types of mixing equipment, including change-can mixers, paddle- or sigma-bladed churns, and ribbon blenders.

Ribbon blenders have several particularly advantageous features, as follows:

(A) The larger batch size (up to 4,000 pounds or more in large blenders) makes possible very good weight-out precision. As a result, uniformity of the composition is at a maximum.

(B) Larger premixes allow more efficient materials handling. Plasticizers, for example, can be pumped through preset volumetric metering devices and sprayed into the blender.

(C) A steam-jacketed blender may be used to make a dry preblend in which the plasticizer has been absorbed by the vinyl resin. This is delivered to the next step in the process at a temperature of 175-200° F. A dry premix can be handled very readily by gravity feed methods: The use of heated premix cuts down the length of the cycle required in a Banbury or similar mixer and, consequently, can be a method of economically increasing production.

Pigments, or, in the case of hard-to-disperse pigments, color pastes, usually are added to the Banbury mixer to minimize the cleaning problems in premixing equipment. Where warranted by the length of a color run, however, pigment may be added initially with the premix.

Final Mixing

The premix, either damp or dry, is then conveyed to the next operation, where it is subjected to intensive mixing, usually in a Banbury, where heat and mechanical shearing action thoroughly disperse and fuse the mix. The 3A Banbury size is probably the most common size in vinyl calender line installations, and normal charge for this unit ranges from 160-175 pounds (or more with some filled stocks). A 2-5 minute mixing cycle is used, depending on the rotor speed range of the machine and the temperature of the premix. Thorough dispersion and fusion are obtained in this length of time, and the stock temperature rises to about 300° F.

The Banbury charge is then dropped to a heated two-roll mill. Although only one mill can be used to sheet out Banbury stock and feed the calender, the optimum milling set-up uses two mills. In this case, the first mill handles the surge capacity from the Banbury and reworks the trim scrap, while the second mill provides a constant, consistently conditioned, even-temperature feed to the calender. Roll temperatures used in milling vary with the gage and type of stock being calendered, the efficiency of the calender heating system, and the speed of calender operation.

Normally, with an adequate calender heating system, stock is milled at or somewhat below the Banbury drop stock temperature, or as cool as possible to obtain the desired calendered product. With heavier gages

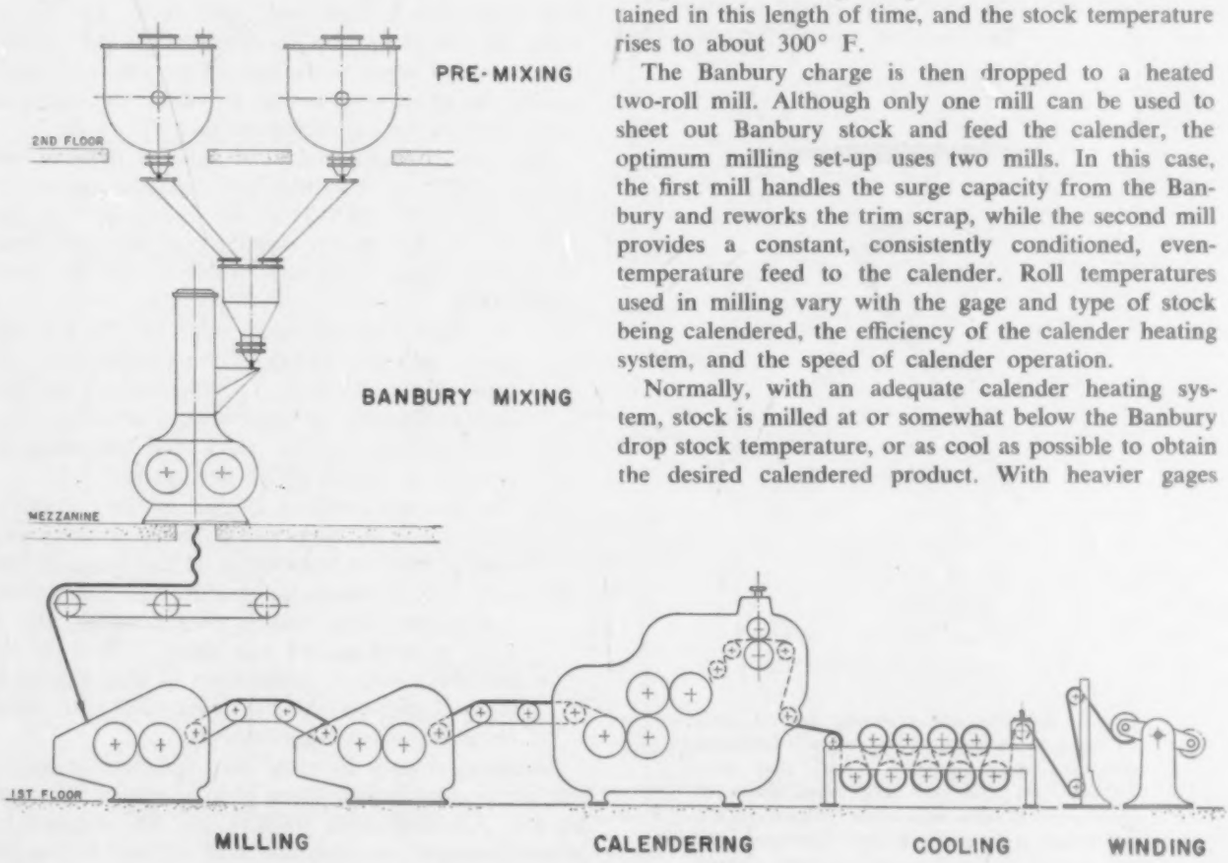

Fig. 1. Schematic view of a modern calendering line

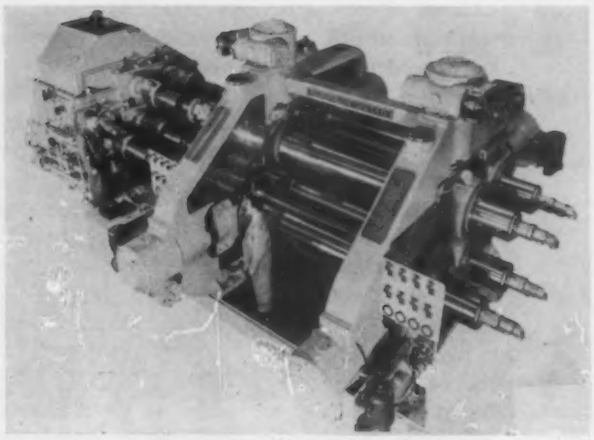

Fig. 2. 28 by 78-inch four-roll Z-type calender with separate pinion stand drive

and, particularly, with three-roll calenders or in a few cases where the calender speed is slow and heating none too ample, stock may have to be milled at high temperatures to furnish as hot a feed as possible to the calender in order to obtain a satisfactory product. Such marginal installations, however, are fairly rare today.

Vinyl stocks handle differently on the mill than rubber. Vinyl is hot, smooth, and lacking in nerve. A slab taken off the mill at 300° F. and hung will support its own weight, although the vinyl sheet is soft.

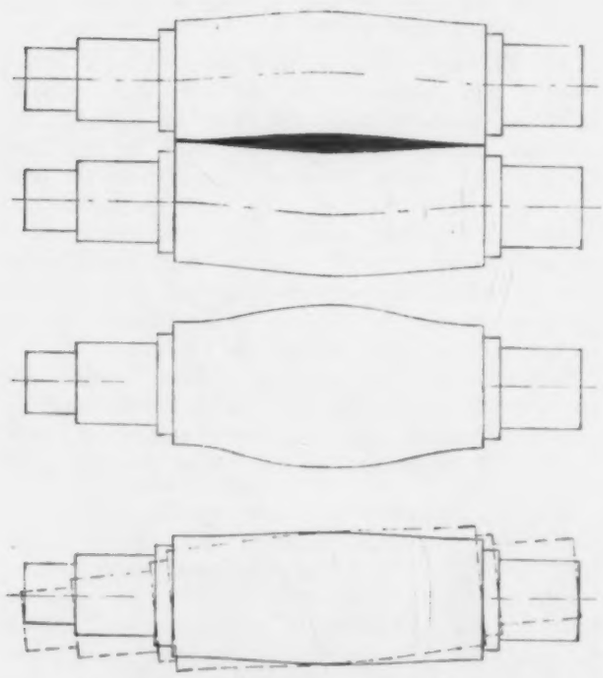

Fig. 3. Calender roll crowning and crossing of roll axes to compensate for roll deflection and film gage variation: (top) Dark area between #3 and #4 rolls shows shape of sheet formed when rolls deflect; (center) #4 roll shape with crown added; (bottom) #4 roll ground to small crown and axis crossed with respect to #3 roll to gain added crown

Calendering

The calender, of course, is the heart of the process. To match the requirements of the industry, the old three-roll rubber calender has been modified substantially. However, it is interesting to note that a few three-roll machines remain in the competition of vinyl calendering today.

The modern plastics calender is invariably a four-roll machine. The majority have rolls arranged in an inverted-L, but many of the most recent installations have roll arrangements of the Z-type (see Figure 2).

The high roll pressures and speeds required in vinyl calendering have resulted in marked advances in roll bearing design. Sleeve bearings have been improved and roller bearings introduced. Hydraulic pullbacks are provided to position the rolls firmly in their operating positions. These devices insure that roll journals are seated in the pressure areas of their journal boxes to overcome the effect of roll "float" in the bearing, since some tolerance must be provided for running clearance at varying temperatures.

Proper roll crown is particularly important in running the lighter gage vinyl films where considerable roll deflection desults from the tremendous separating forces. The amount of crown required depends on several factors, chief of which is the relation of roll diameter to length. Single-arc crowns generally do not furnish the uniformity of gage across the sheet that is demanded in vinyl products today, and compound-arc crowns are common. Where uniformity of film thickness across the sheet is required in a range of gages or formulations, crossing of the roll axes (also called roll cambering) is furnished. This device operates to swing the axis of rotation of one of the last pair of rolls, thus opening the gap at the ends of the rolls and accentuating the effect of crowning to enable the operation to compensate for roll deflection (see Figure 3).

As a thermoplastic, polyvinyl chloride requires heat during processing. Calender roll temperatures in the neighborhood of 310-340° F. for light gage film, and 330-360° F. for heavy sheeting are normal. These temperatures pose two key problems for the vinyl technologist:

(1) As vinyl chloride compounds are heated, viscosity decreases owing to the thermoplastic nature of the material. To obtain the even flow and uniformity of gage control required of a good quality product, stock and roll temperatures must be controlled accurately.

(2) The second problem is one of heat stability, since the high temperature levels of processing tend to initiate degradation of the polymer. Not only is it necessary to stabilize the composition against the heat history of processing, but it must be remembered that about 15-30% of the calender's output, in the form of trim edges and rejected start-up material, is recycled even under favorable operating conditions.

Stabilization must be more than sufficient to handle this scrap re-cycling or there is an ascending spiral of trouble. Adequate heat stability can be obtained by proper formulation, using the most efficient heat stabilizing agents and proper control of process conditions.

Recent developments in vinyl stabilizers have made available the very effective combination of barium-cadmium organic compounds used in conjunction with a chelating agent.

Control of calender roll temperatures is one of the most important aspects of vinyl calendering and, consequently, has been the subject of much engineering design investigation. Although heat must be supplied to the rolls when operated at lower speeds, a different situation prevails in high-speed calendering. Since high production rates are quite important from the economic standpoint, speeds of 80-100 yards per minute are common in light film production. The shearing action and heat build-up involved when a material of molasses-like consistency is forced through a gap 66-92 inches wide and 0.003 inch or less thick at these peripheral speeds are apparent. Under such conditions, a system is required to remove the excess heat generated, and at a low temperature differential.

The older, cored calender rolls have been inadequate under these heat-transfer conditions. Rolls are now drilled along the periphery beneath the chill-hardened surface and as closely as practicable to the working surface, in order to provide effective temperature control and greater uniformity of temperature across the entire roll face. Hot water under constant circulation is the optimum medium used for heating and cooling the calender rolls over the entire speed range. The temperature of each roll must be adjusted separately and maintained automatically. Usually, the most effective hot water systems have a pump for each calender roll (see Figure 4).

This type of design and operation has made gage control a phase of the process in which the vinyl calendering industry has made a real achievement. The production of 0.003 inch thick film up to 72 inches wide, with not more than an 0.003 inch variation across the sheet or along a continuous length, is evidence of a high standard in performance of bearings, careful machining of calender rolls, and close control of operating techniques. Continuous gaging mechanisms are now available and increasing in usage, since they allow immediate roll adjustment when required.

Continuous embossing tied in with the calender operation is now common. Embossing equipment can be installed within the calender frame and the operation accomplished while the calendered product is still hot, without the necessity for supplementary heating. In many cases, the embossing installation must be located further from the calender. In such cases supplementary heating, usually by electrical units, is required to condition film for this operation.

Final Handling

The last major step in the calendering process involves stripping the hot, soft thermoplastic sheet from the calender, and cooling and winding it with a minimum application of stress. Strains in vinyl film and sheeting tend to relieve gradually, rather than immediately as in rubber, because of the viscoelastic properties of vinyl chloride. As a result, any set-in strain can cause undesirable shrinkage in the vinyl product. Therefore, although the cooling and winding steps appear simple, they are a critical part of the operation for the unsupported product.

Experience has shown that sudden cooling causes unfavorable shrinkage patterns and much subsequent

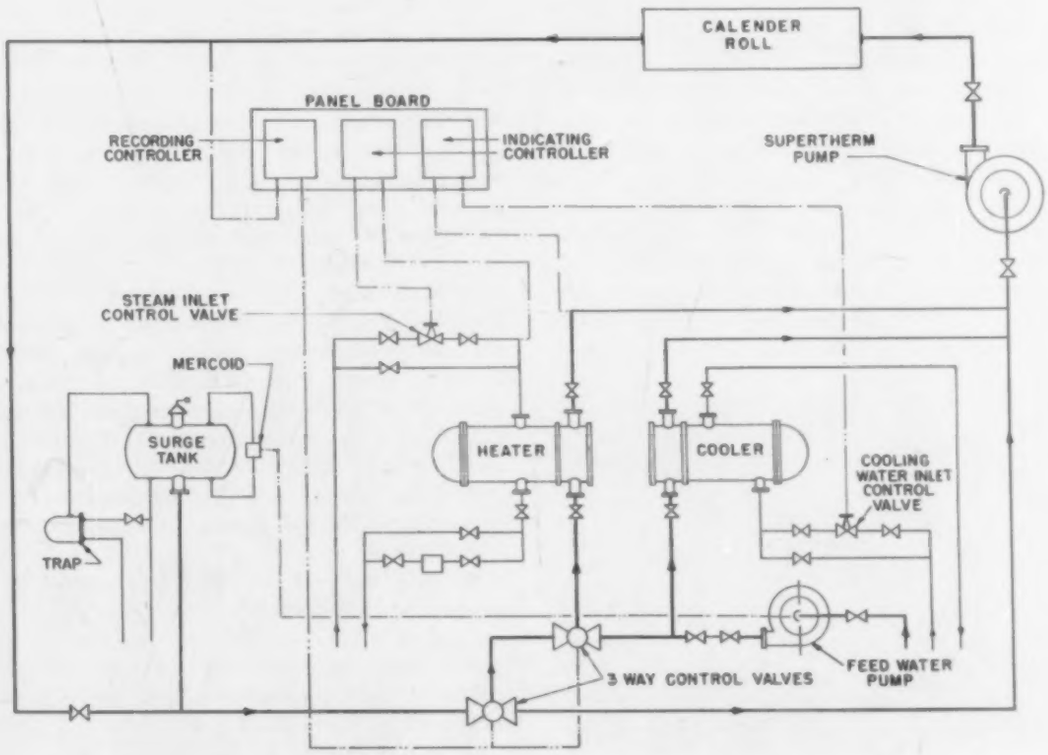

Fig. 4. Schematic view of temperature control system for circulating water in vinyl calender

Fig. 5. Speed control of stripping and embossing rolls, and each bank of cooling drums in a post-calendering train

rejected material. Consequently, it is good practice to allow several feet of air-cooling between the last calender roll and the first cooling drum. The number of cooling drums in the train can vary considerably with different installations. The most modern high-speed calender trains employ as many as nine cooling drums before the winder. In these installations, the best practice is to have the first two or three drums equipped and instrumented for controlled circulating hot water, and the remaining drum instrumented to discharge water at pre-determined temperatures so as to secure gradual and controlled cooling of the product down to room temperature.

Proper speed control in the post-calendering train also is essential. Speed control is provided for the stripping roll, embossinng rolls, and for each bank of three cooling drums in the cooling train (see Figure 5). Speed settings of these elements in relation to the calendering speed must be calculated carefully to counteract the effects of stretch during embossing and of shrinkage upon cooling so as to wind a smooth, firm roll with as little tension employed as possible.

There are automatic winders now in operation which wind the pre-determined yardage of product, rotate the next bare core into position, cut off the finished roll, and start the new roll while at the highest speeds of calender operation. Both center-driven and surface-winding units are available.

Vinyl-coated fabric is also economically produced by the calendering process and, in fact, about 30% of the calendered vinyl sheeting produced today is on fabric. The process is essentially the same as for unsupported vinyl sheeting, with the fabric introduced between the third and fourth calender rolls. Normally, it is not necessary to prime-coat the fabric to obtain satisfactory adhesion.

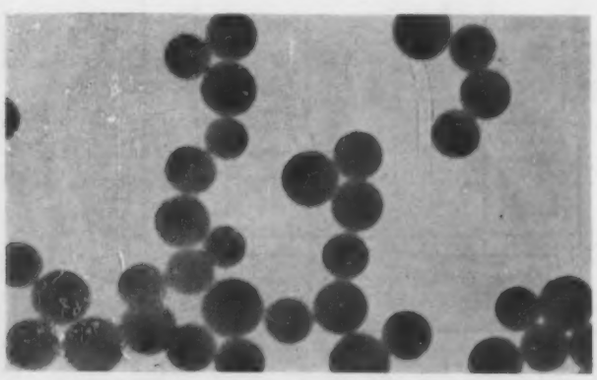

Fig. 6. Magnified photograph of PVC resin particles in a plastisol

Plastisol Coating Method

An entirely different approach to vinyl-coated fabric manufacture is made with the use of plastisols. This process is based on a polyvinyl chloride resin which is made up of tiny spherical particles, as shown in Figure 6. A suitable plastisol resin has a particle size range of 1-2 microns.

These particles are suspended by a simple stir-in process into the plasticizer which acts as the vehicle. A high-speed mixer is used and the other ingredients, such as pigments and stabilizers, are mixed in at the same time. The viscosity of the resulting paste is similar to that of heavy cream or house paint. While a plastisol is liquid, it is spoken of as being 100% solids since it contains only the ingredients of a normal vinyl stock.

The plastisol compounder has an additional dimension to cope with in developing his formulation. The viscosity of the plastisol and, hence, its fabric-coating characteristics, depend on the type of plasticizer used, and the amount and the length of storage time of the plastisol prior to the coating operation. Even the temperature of storage is a factor in this complicated equation. The initial viscosity and the viscosity shelf life obtained with seven representative plasticizers is indicated in Figure 7.

P. R. Graham, Organics Division of the Monsanto Chemical Co., has pointed out that, depending on the viscosity requirements of the process itself and the length of storage time required, a "custom-made" plastisol can be prepared. An appropriate mixture of the low-solvating type plasticizer, such as DIDP, to obtain good viscosity shelf life, plus a high-solvating plasticizer (Santicizer 160) to give better fusion at elevated temperatures, is the way to accomplish a balanced formulation.

Another method of viscosity control frequently resorted to is the addition to the plastisol of a limited amount of a mineral spirits thinner to make a "modified plastisol," or organosol, with lower viscosity.

The plastisol method of fabric-coating is essentially comprised of the following steps:

(a) Stir-in mixing of the plastisol resin, plasticizer, and other ingredients to make the plastisol.

(b) Coating the plastisol on fabric, usually with a knife coater.
(c) Heating the plastisol coating to a temperature of 350° F.
(d) Final handling, including embossing, wind-up, etc.

A schematic layout of a typical plastisol fabric-coating process is shown in Figure 8.

There are a number of methods of coating, with some variation of the floating knife in most common use. In this case, the knife is set down between the supports for fabric passing under it. Plastisol in front of the knife is carried through by the fabric, with the coating gage determined by the angle and shape of the knife and the tension on the fabric.

Conversion of the unlikely-looking, pasty coating on fabric to a tough, finished vinyl-coated fabric is a relatively simple process. The plastisol coating is raised to approximately 350° F., at which temperature it will fuse to a solid mass. This processing step appears similar to rubber curing, and often is spoken of as a curing operation. However, it is not a chemical reaction as is the case with rubber vulcanization. Rather, a physical change takes place, with inversion of the suspension of resin in plasticizer and solution of the plasticizer in the resin. The methods of raising the coating to the temperature generally employ either hot air convection or infra-red or radiant electric heat.

One of the limiting factors on the processing rate for this method of fabric coating is that the entire mass of

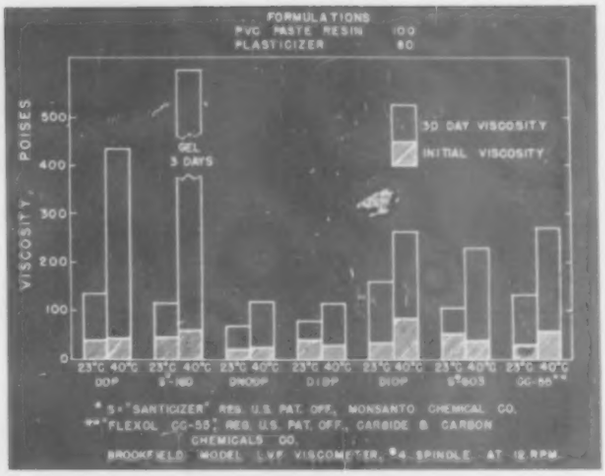

Fig. 7. Initial and shelf-life viscosities of various phthalate plasticizers for vinyl

the coating must be raised to the fusion temperature, even though momentarily, in order to achieve full physical properties. However, the intensity of the heat source or the temperature of the air must not be so high that the top of an 0.008 inch thick coating, for example, is scorched in order to fully fuse the bottom. The alternative is to use a lower temperature heat source and a longer heating time, with a consequent drop in production rate. In order to increase the rate of production in this case, a longer operating at the lower

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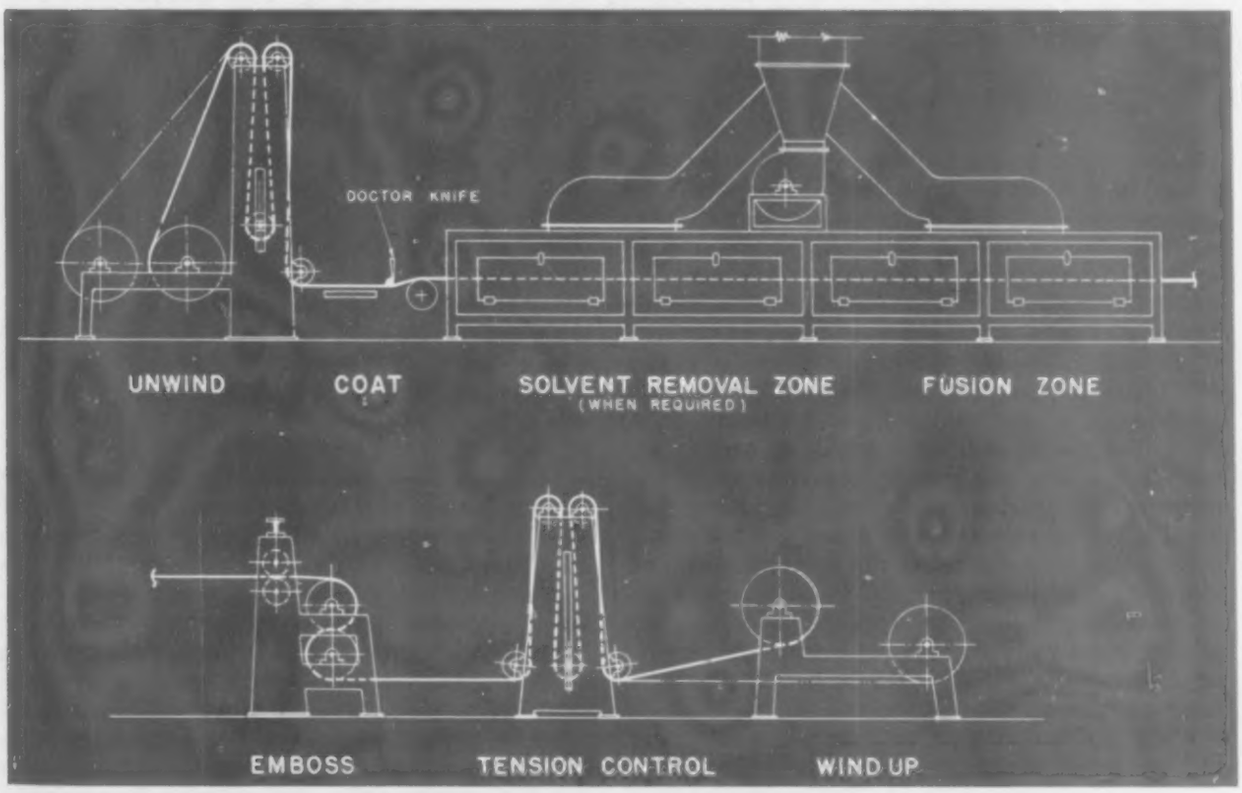


Fig. 8. Schematic view of a plastisol fabric-coating line

The Dry Offset Process for Decorating Molded Plastics

A high-speed method for applying multiple colors in close register to plastic surfaces of widely varying contours.

CARL R. JOHNSON, *Chief Chemist*
Markem Machine Co., Keene, N. H.

With the growth in the use of plastics in common household items, toys, advertising novelties, and especially, in containers for food or cosmetics, there has come an increasing demand for improved production methods of applying attractive, durable decorations to molded plastic surfaces. Several methods of applying decorative designs have been known and used for many years, but each has limitations. Production speed, cost of materials used, number of colors which can be economically applied, allowable contours of surfaces to be decorated, quality of appearance, and durability of result are factors one or more of which limits the effectiveness of conventional, widely used decoration methods.

Markem Machine Co. has been solving industrial identification or decoration problems for more than 40 years. We design and build machines, develop and manufacture inks and marking materials, engrave or mold metal or rubber printing plates, and sell these items in proper combination as a complete package to industrial plants for them to use to accomplish their identification or decorating jobs. In our standard line are machines, marking compounds, materials, and printing plates using almost every technique commonly required in the decorating field, and covering a wide range of production speeds.

We have been carrying on research, development, and evaluation work concerning these techniques as the plastics industry has grown. This paper reports on results obtained through the increasing improvement of the dry offset technique which seem to have fewer limitations than other methods when all factors are taken into consideration.

Decorating Methods

Before discussing dry offset, let us review the normally-used methods of printing or decorating plastics, and indicate our reasons for investigating dry offset.

We can divide the methods of decorating plastics initially into two broad classes:
(1) Applying labels or decalcomanias; and (2) applying a coloring material such as ink or paint in a desired design. We will concern ourselves with the second of these two, since we are not producers of labels or decalcomanias and, therefore, have not included them in our work.

There are three fundamental methods of applying coloring material such as ink or paint to plastic surfaces. They are flat impact, stencil, and rotary impact methods (see Figure 1).

Impact methods suitable for use on molded plastics are cold-process rubber plate printing with specially formulated inks, and hot stamping using roll leaf or specially formulated inks as the color applying materials.

Cold-process rubber plate printing, a version of letterpress, is coming into wider use every day. Rubber plates of proper design are mounted in specialized flat-bed machines. Inking rollers apply ink to the face

of the rubber plates and the plates are pressed against the plastic part leaving the ink where desired. This process can be done at high speed, and inks are available today which give durable results on almost all plastic surfaces. Properly used, the method will produce excellent quality, economical single-color work on flat surfaces without danger of breakage.

Hot stamping is done normally with roll leaf and metal printing dies. Special inks are used sometimes instead of roll leaf, and sometimes heat-resistant, semi-flexible dies made of silicone rubber or similar materials are used, but the standard method uses roll leaf and metal dies. The leaf is held between the heated die and the plastic surface. When the heated die is pressed against the leaf, the coloring material on the other side of the leaf transfers to the plastic surface. This hot stamping produces very durable, single-color marks economically at quite good production rates. Breakage or fracture of the parts is not a major factor if hot stamping is taken into consideration in designing the piece.

Stencil decorating normally is done using photographically produced stencils supported on fine-mesh silk or metal screens. Ink or paint is pressed through the stencil with a rubber squeegee while the stencil is in contact with the part. This process is known as silk screening. Some use is now being made also of stencils with paint spray guns. The gun sprays paint on a metal stencil held against the plastic part, and whatever design is cut into the stencil appears on the plastic part.

Silk screen stencilling (see Figure 2) is rather widely used, and can produce quite intricate designs with good clarity and heavy color coverage. The heavy coverage causes some drying problems but, in general, the process can be widely useful on flat or cylindrical surfaces to produce good results. Spray gun stencilling is used today primarily for filling cavities molded in the piece, and for covering comparatively large overall surfaces.

Most rotary impact methods (see Figure 3) resemble those of flat impact in that cold-process rubber plates or hot metal dies can be used to print directly on the plastic part using ink or roll leaf. When the rotary method is used for direct printing with rubber or metal dies, the results are similar to those of the flat impact methods; that is, single-color designs are produced economically. The rubber or metal dies are mounted on drums instead of flat and the drum rotates against the surface being printed or decorated and the ink or foil is applied to that surface directly by the die.

Offset Printing

All offset printing is a planographic process (see Figure 4). The coloring compound, normally characterized as "ink", is applied to the surface being printed from a plane surface, and is not applied directly from raised characters such as a metal or rubber die. The planographic surface in current practice is normally a rubber or synthetic material held smoothly on a drum or a flat plate. The desired design in one or more colors is put on this plane surface by printing plates to which

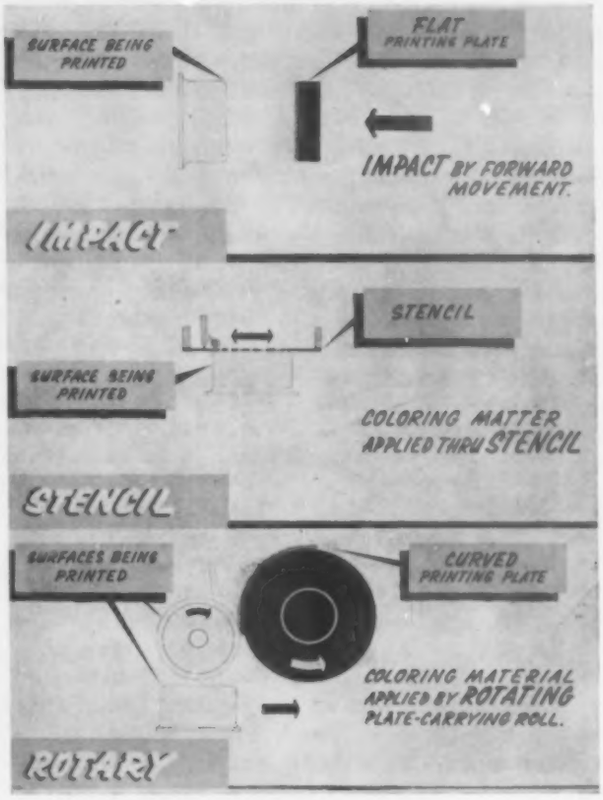


Fig. 1. Basic printing or decorating methods: (top to bottom) Impact, stencil, and rotary

the ink has been applied by inking rollers, hence the method is a two step process. The ink is put onto a printing plate which prints onto a planographic surface (normally called an "offset blanket") which, in turn, applies the imprint to the piece being printed. The ink, therefore, can be said to be offset by the blanket from the printing plate to the surface being printed.

Dry Offset Method

In the "dry" offset method, the printing plate itself is normally a zinc etching for short runs, and a brass engraving or hard-faced electrotype for long runs. Basically, therefore, by dry offset we are referring to a printing method employing one or more inking mechanisms which apply the desired inks to the surface of one or more flat or curved metal printing plates

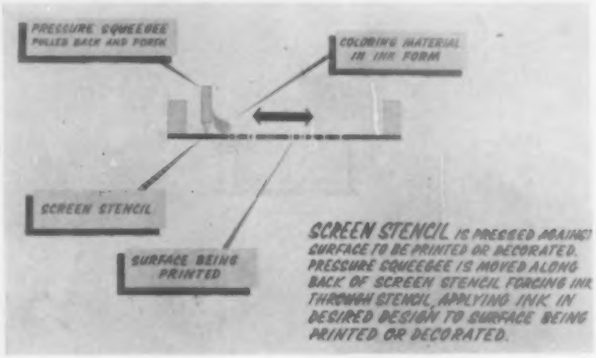

PRESSURE SQUEEGEE PULLED BACK AND FORTH
COLORING MATERIAL IN INK FORM
SCREEN STENCIL
SURFACE BEING PRINTED
SCREEN STENCIL IS PRESSED AGAINST SURFACE TO BE PRINTED OR DECORATED. PRESSURE SQUEEGEE IS MOVED ALONG BACK OF SCREEN STENCIL FORCING INK THROUGH STENCIL, APPLYING INK IN DESIRED DESIGN TO SURFACE BEING PRINTED OR DECORATED.

Fig. 2. Stencil decorating or silk screening method

which, in turn, apply the inks to the surface to be printed or decorated. Right here is an immediate advantage of dry offset over other methods in wider use today: it lends itself admirably to multicolor work. In fact, the number of colors which can be applied simultaneously in close register is limited only by the design of the machine using the process.

We decided to do research on the dry offset method because it was and still is our belief that while each of the other decorating techniques described had certain favorable factors, only dry offset offered a means of applying multiple colors in a close register at good production rates to surfaces which might vary considerably in contour, firmness, and fragility.

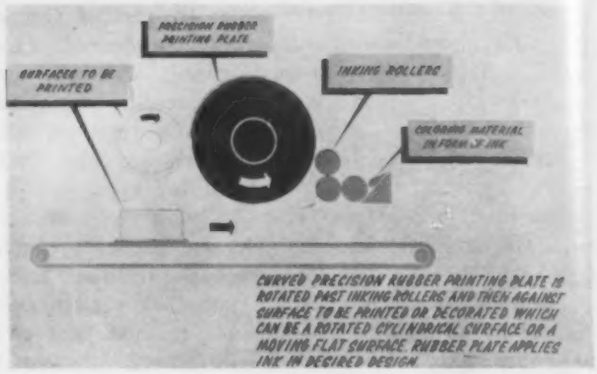

PRECISION RUBBER PRINTING PLATE
SURFACES TO BE PRINTED
INKING ROLLERS
COLORING MATERIAL IN FORM OF INK
CURVED PRECISION RUBBER PRINTING PLATE IS ROTATED PAST INKING ROLLERS AND THEN AGAINST SURFACE TO BE PRINTED OR DECORATED WHICH CAN BE A ROTATED CYLINDRICAL SURFACE OR A MOVING FLAT SURFACE. RUBBER PLATE APPLIES INK IN DESIRED DESIGN

Fig. 3. Rotary printing by the rubber plate method

Experimental Development

We decided to approach our development work by modifying the principles used in rotary plate machines. These are high speed (3,000-10,000 pieces per hour) cylindrical object printers which use a single-roll combination inking and reservoir unit to apply the ink to the surface of the drum-mounted rubber plate which, in turn, applies the ink to the surface being imprinted. Some have a chute feed and escapement mechanism to allow automatic feed of straight-sided items, while others use a chunk or mandrel type holder to hold items of varied shapes. Many hundreds of these machines are in use on plastic and glass items.

A prototype dry offset machine was produced by combining two of the inking and printing plate drum units, properly located in relation to a single drum on which we placed a rubber-surfaced offset blanket. What had appeared to be a fairly simple procedure of combining familiar elements turned out to be a succession of problems. As one was solved, another problem would pop up.

The production of rubber plates of close enough register at a reasonable price proved impractical, so we shifted to metal plates. This meant a change in the inking mechanism so as to ink metal plates. Then we found that inks that will adhere to the plastic materials we wished to print had to be worked differently in the inking reservoir mechanism for offset work than in conventional inking units, so a new inking mechanism was developed.

Next, a method of maintaining accurate alignment of the metal printing plate drums to each other and to the offset drum, which at the same time would allow adjustment of pressures, had to be developed. Soon it became apparent that there had to be coordination of the offset blanket material with the inking roll material for the inks used. Since we were going to use inks suitable for vinyls, polystyrenes, polyethylenes, phenolics, and other plastics, we had a great deal of evaluating to do to arrive at materials as nearly universal as possible. Then an interrelation of surface speed, pressure of plate to blanket, and pressure

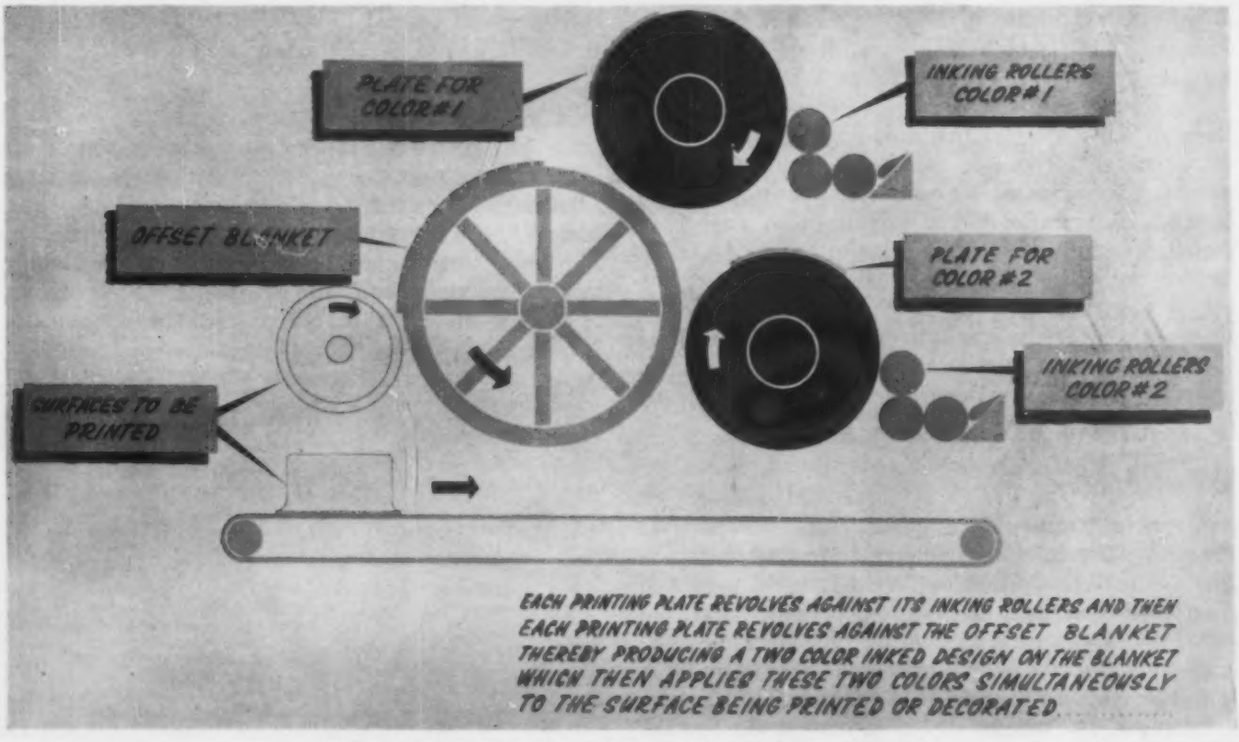


PLATE FOR COLOR #1
INKING ROLLERS COLOR #1
OFFSET BLANKET
PLATE FOR COLOR #2
INKING ROLLERS COLOR #2
SURFACES TO BE PRINTED
EACH PRINTING PLATE REVOLVES AGAINST ITS INKING ROLLERS AND THEN EACH PRINTING PLATE REVOLVES AGAINST THE OFFSET BLANKET THEREBY PRODUCING A TWO COLOR INKED DESIGN ON THE BLANKET WHICH THEN APPLIES THESE TWO COLORS SIMULTANEOUSLY TO THE SURFACE BEING PRINTED OR DECORATED

Fig. 4. Two-color offset or planographic method of printing

of blanket to plastic was uncovered, and found to vary with different inks and blanket materials.

Suffice it to say, these and other problems were solved one by one, and in May of 1954, a prototype machine was put out for a production test consisting of decorating polystyrene molded items with two colors applied to compound cylindrical contours. That machine has been in constant use by the purchaser since it first went to his plant, and is still in use.

Results Obtained

From our work with the original machine and the redesigned model now in production, we can draw some conclusions at this time. None of these conclusions are final, however, because work continues on further development of the practice.

We find that the method definitely allows production speed application of multiple colors in good register. This multicolor application can be put on surfaces of widely varying contour. However, the more the contour varies from a flat surface, the more the distortion of the imprint and the poorer the quality of ink coverage. On a straight-sided cylinder or a flat surface, the quality and freedom from distortion are excellent, while on pieces of odd shape they are acceptable for most decorative work.

The piece being imprinted must offer a firm surface to the offset blanket. For example, to get really good results on polyethylene squeeze bottles, we automatically apply air pressure inside the empty bottle to make its surface firm against the blanket. Filled squeeze bottles are firm enough for good quality work.

The covering density of color applied varies with the speed of the machine, but even at low speeds does not allow the application of white or light colors to black or very dark colored items. A corollary to this is that color matching must be done with full knowledge of the base plastic color on which the applied color is to go, since the base color must be compensated for in formulating the ink color match. Despite this, good color matches can be made for application to light or medium dark plastic surfaces.

As would be expected, durability of the decoration depends on whether or not the ink can get a chemical bite into the surface of the plastic. On styrene, vinyl, and similar materials, durability of the inks is very acceptable. On melamines and similar inert materials, however, the durability is not as great as the hot stamping processes. Since there is no universal ink, the ink must be matched to the plastic on which it is to be applied. A change of ink may well require a change in inking roller and offset blanket materials. Residual mold lubricants left on the plastic surfaces do great damage to ink adhesion and durability.

In addition, this process does not lend itself to frequent starting and stopping. Superior results are obtained when the machines are on steady production runs, and are thoroughly cleaned up if work is stopped for more than a 15- or 20-minute period.

Conclusions

While limitations exist at present, development work continues on the dry offset process. The validity of Markem's original thinking is proved by machines now in use in molders' plants for applying two colors in good register to flat, cylindrical, and odd-shaped pieces at good production rates. Machines using three and more colors are now under construction in our development department.

—THE END

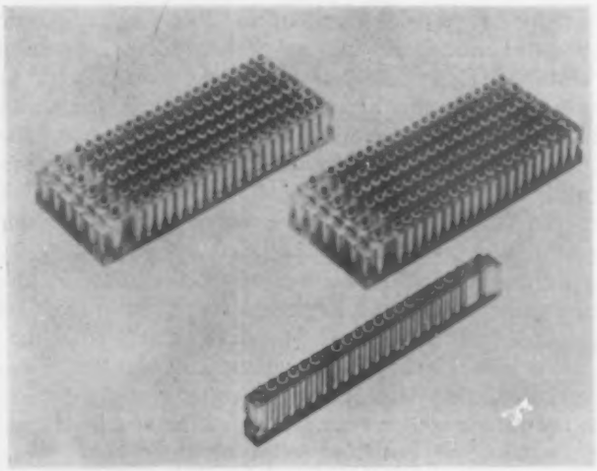
Epoxies Permit Precision Casting

A series of 21 delicate spring-loaded electrical contacts were imbedded in blocks of cast epoxy resin by Boonton Molding Co., Boonton, N. J., to form a unique electro-mechanical assembly for the electronics division of Air Associates, Inc.

Epoxy resin, supplied by National Engineering Co., and augmented with fillers to improve its stability under ambient temperatures, was selected for the job owing to its high dimensional stability and electrical insulating properties. Previous attempts to mount these contacts in metal holders proved prohibitively expensive, and other types of plastics were ruled out since molding pressures would crush the thin metal shells of the inserts.

The application of this assembly required precise location of each contact. The inserts were assembled, soldered to a common buss bar, and placed in jig-boarded, fabricated steel molds. Resin was poured under a vacuum in order to eliminate air bubbles, and the filled molds were transferred to an oven and cured. The exact application of the unit is listed as classified information.

—THE END



Transparent epoxy castings reveal imbedded electrical contacts

Case Study

Fabricating The World's Largest Hereford Bull

A careful choice of plastics and ingenious engineering were the factors responsible for the existence of the three-times life size Hereford bull that made headlines some few months ago. This bull, one of the largest three-dimensional self-supported plastic figures yet fabricated, was hoisted last October amid great civic fanfare atop a 90-foot pylon at the new Kansas City, Mo., headquarters building of the American Hereford Association (see Figure 1). The plastic bull has passed through a hot summer and a severe winter, and shows no signs of weathering.

Behind the display lies an interesting development story covering two years of experimentation with the molding, joining, and lighting of plastic forms.

The job of fabricating the red-and-white skin of this king-sized Hereford, which measures 19 feet, 7 inches from nose to tail and 11 feet, 8 inches from hoof to horn, was undertaken by Colonial Plastics Corp., Newark, N. J., under contract from the prime contractor, Colonial Neon Company, Inc., North Bergen, N. J. Two other national advertising sign companies, previously approached by the Hereford Association, refused to bid, saying the job couldn't be done. Colonial Neon undertook the job as a challenge as well as a business venture.

The internally-lighted bull is made from 39 molded sections of glass fiber-reinforced polyester plastic mounted around an internal framework of structural steel (see Figure 2). The molds were made with an extraordinary attention to realistic detail. Starting with a seven-inch scale model of an "ideal" specimen of the breed furnished by the Association, Colonial Neon commissioned the New York sculptors, Rochette and Parzini, to produce a ¼-scale model, from which they later graduated to the full-size clay model.

Before the final model was completed, the sculptors made several trips to a cattle-breeding farm in the East to obtain authentic details of the Hereford's configuration, coloring, and hair texture. The full-scale model was marked off then into 39 sections, with careful attention to lay out the section boundaries to fit natural body contours wherever possible. Strips of sheet metal were fastened along the boundary lines to permit ready removal of the individual female mold sections after the plaster had dried. The female molds were made from Hydrocal reinforced with steel rods and braces.

While the various models and molds were being made, Colonial Plastics turned to the problem of selecting both a suitable plastic and a production method to meet the

Fig. 1. Plastic bull on pylon atop headquarters of American Hereford Association in Kansas City, Mo.

Fig. 2. Assembled Hereford in final illumination check before shipment. The beams protruding from the legs are the upright members of the internal supporting framework

specifications set by the Association. For example, the skin must withstand wind pressures of 110 miles per hour, and resist impacts from hailstones without deformation or fracture. Furthermore, it had to weather successfully all sorts of atmospheric conditions, including temperatures between — 40 and +120° F., and prolonged exposure to direct sunlight without chalking, fading, or loss of strength.

After considering the various plastics, Colonial decided on reinforced polyester because it has the necessary physical properties and can be molded to intricate contours without specialized equipment. The formulation chosen was Paraplex 431, manufactured by Rohm & Haas Co. and designed for excellent color stability in the presence of ultra-violet. The resin is easily pigmented, and has good wetting characteristics with glass fiber. Several sample pieces of the polyester were checked out in 100-hour Fadeometer tests, and in impact tests using ice cubes to simulate hailstones falling at terminal velocity.

In the sequence of operations for molding a typical piece, the first step was formulating batches of pigmented Paraplex resin with the catalyst, accelerators, and polymerization agents generally used in polyester work. The batches were mixed for about 15 minutes. Meanwhile, the glass fiber mat (4-6 ounce weight) was being cut to length. The mat used was of mechanically-bound construction to provide the flexibility and strength needed on short-radius bends, such as horns and tail. It was furnished by the fiber division of the Bigelow-Sanford Carpet Co.

After the resin was mixed, it was poured onto the mat (see Figure 3) at a rate of about 9 ounces of resin per square foot, with careful kneading to assure complete penetration and saturation of the mat which had previously been placed on a sheet of polyvinyl alcohol film. The impregnated mat and the underlying vinyl sheet were then transferred to the mold and the mat trimmed to shape. The film assured good release from the mold and provided a smooth uniform surface on the molded piece. A second sheet of vinyl film was placed over the mat and manually pressed down for good compaction and penetration of the resin (see Figure 4).

Encasing the mat in the film prevented air from inhibiting the reaction and evaporation of volatile components during the initial curing period. In some cases, the edges of film were sealed with tape to form a "bag," and the air evacuated with a vacuum pump. This not only removed any entrapped air, but also helped "work" the resin completely into the mat and assured firm contact between the mat and the mold contours.

The initial cure at room temperature ranged from 3-20 hours, depending on the temperature, the size of the piece, and other factors. After the initial cure, the piece was removed from the mold and given a final

Fig. 3. Applying the resin to the glass mat which, in this case, is a red section of the "skin". The polyvinyl alcohol film under the mat is transferred with the mat into the mold

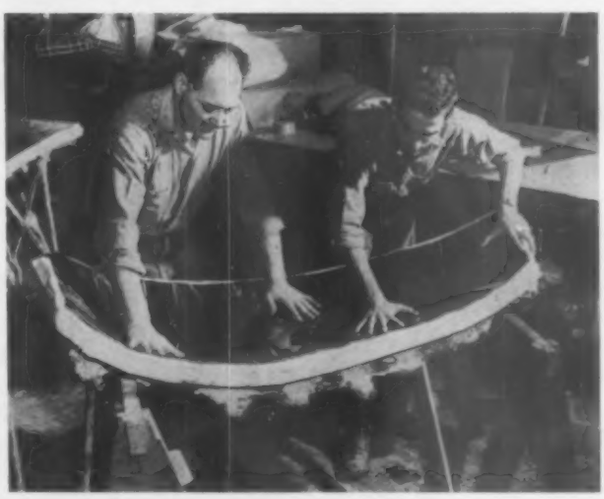


Fig. 4. Manual pressure on the upper layer of polyvinyl film assures good penetration and compaction of the resin and glass mat

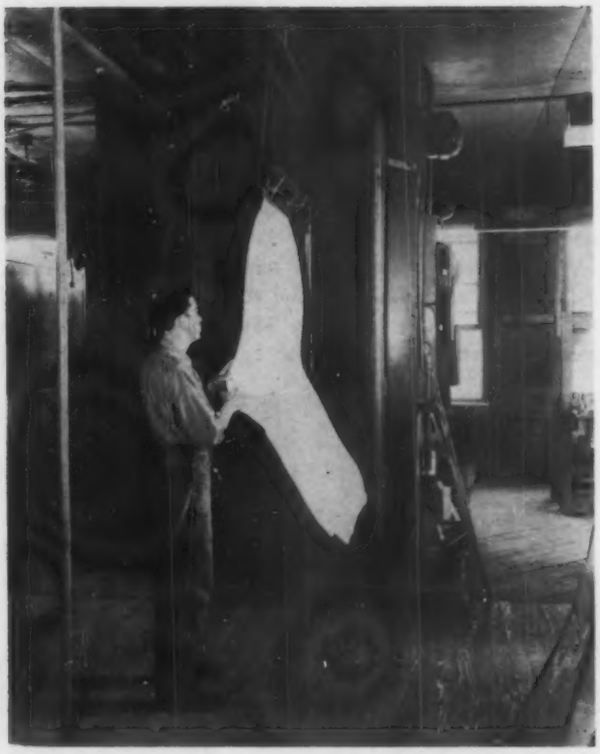


Fig. 5. A section of the Hereford's underside is moved into the oven for final cure at 200° F

oven-cure for 2-3 hours at 200° F. (see Figure 5).

A tricky problem arose in fabricating the two-color sections; that is, where a red-and-white boundary occurred in the same mold. Because of the difficulty of cementing polyester after it is cured, it was necessary to join adjacent red-and-white parts before the final cure. At first, Colonial attempted to fit these pieces together just after they were impregnated, but the red pigment tended to migrate into the white sections. This difficulty was solved by curing the fitting pieces separately (see Figure 6) until the resin was set sufficiently to prevent migration, and then fitting the pieces together in the mold. The application of a little unpigmented resin at the joint seam helped to solidly fuse the two pieces during the remainder of the cure period.

For purposes of assembling the individual sections, L-shaped flanges of reinforced polyester were fused onto the inside surface flush with the edges, and the mating flanges then bolted together. Originally, it was planned to mount long, one-piece flanges, but Colonial found that the increased thickness of material along the seams created a dark line several inches wide when the internal lighting system was turned on. The shadow was eliminated by using the small individual flanges spaced at intervals along the seam, instead of the continuous flanges. For extra strength and rigidity, steel wire sutures were laced across the seam at two-inch intervals.

The skin was assembled around a steel structure composed of six-inch I-beams for the four vertical members which protruded through the bottom of each hoof, and of four-inch beams for the cross members. The skin was attached to the framework by means of a series of rods that are sufficiently flexible to compensate for differences in thermal expansion between the skin and the steel framework. It was calculated that there would be a 1½ inch change in length with seasonal temperature variations.

The arrangement of the internal lighting to provide equal light intensity through the red-and-white sections required much experimentation. More than 700 linear feet of high-intensity cold cathode tubing, formed into eight-foot hairpin sections, were used for the lighting. These tubes, mounted on the steel framework, were located to concentrate most of the light at the white sections of the skin, thus matching the light intensity coming through the more translucent red sections. The lights were hooked up into several circuits to permit variation in overall intensity in service.

Cold cathode lighting was used because of its reliability over the full range of outdoor conditions. Other advantages of the cold cathode tubes were formability, instant start, controllable density and long service life. A bomb-bay door in the belly of the bull provides access to the interior for maintenance.

After the lighting was installed, the skin was found to be somewhat too transparent so that the shadow of the framework was visible in bright sunlight. The translucence was diminished by coating the inner surface of the skin with pigmented acryloid. The acryloid also was used to darken the areas around the seams in order to blend in with the dark lines created by the seams. For maximum toughness and weather resistance, the entire outer surface of the skin was given a final coating of clear acryloid.

For water tightness, the light globes of the two avi-

(*Continued on page 499*)

Fig. 6. Red-and-white molded pieces receiving the initial "air" cure. The quarter-size model of the bull is on the table at right. In the background, completed pieces are being assembled into the final skin

Reinforced Laminates in Aircraft Tooling*

Fabrication technique, properties, and aircraft applications of fiberglass-reinforced plastic tooling of the cold-set type.

RICHARD MOROWICZ, *Plastics Engineer*
Douglas Aircraft Company, Inc., Santa Monica, Calif.

The ability to mold a stable and accurate mating surface to any contour without the use of force is indeed an achievement. Such has been the goal desired in the tooling industry with the advent of man-made plastic resins and woven glass fabric.

Even though the items to be presented may be considered repetitive to some individuals, a definition of laminating materials and an explanation of the basic techniques utilized in the fabrication of a reinforced laminate tool should be expressed for maximum clarity.

Laminated fiberglass tools incorporating clear, unfilled plastic resins are recognized by generally green, brown, or white colors possessing a degree of translucency, and also by their lighter weight (specific gravity 1.5-2.0) when compared to an equivalent dimension in steel or aluminum.

A reinforced laminate to be used in tooling generally will incorporate layers or plies of woven glass fabric, ranging in dry thickness from 0.008-0.090 inch, impregnated with a liquid synthetic binder, and "cured" to a hardened mass. Woven glass fabric has been the most satisfactory reinforcement for producing strong plastic laminated constructions.

In tooling, hardening or curing of the plastic resin binder generally is accomplished by adding a proportioned amount of a suitable accelerator, hardener, or curing agent. Mixing the plastic resin and curing agent produces a hardened mass within a short length of time without the use of external heat or pressure.

Fabrication Sequence

A typical fabrical sequence for the relatively simple plastic tool to make an aluminum doubler with a scalloped edge is shown in Figure 1. This part will require a single mating surface trim tool (see Figure 1-A) ¼-inch thick, whose edges provide a guiding surface to rout-trim the formed aluminum part (see Figure 1-B) to the net dimensions.

From the specifications of the tool drawing, it was decided to lift a plaster splash or mold from the master pattern (see Figure 1-C) and build up a plaster wall at the part trim line (see Figure 1-D). The built-up plaster splash acts as the mold for the fabrication of the reinforced laminate and, therefore, was treated an hour or

* Based on a paper presented before the American Society of Tool Engineers, Los Angeles, Calif., March 15, 1955.

two after receipt from the plaster department by the application of a suitable sealer and parting agent. No drying of the plaster was necessary; the correct sealer will allow lamination over "green" or damp plasters.

Careful attention was given to the filling of all pinholes (if any) in the plaster surface, and final smooth sanding performed after each coat of the sealer. Thirty minutes after the final seal coat application, high gloss was imparted to the plaster surface by a suitable parting agent which also eased removal of the laminate from the mold surface.

A small portion of resin and hardener was dispensed and mixed thoroughly to assure even dispersion of the hardener within the resin. A thin coat of catalyzed resin was brushed onto the mold surface and allowed to gel partially to a gummy state. During this 15-minute period, major air-bubbles were eased out of the resin film with a brush, and the fiberglass cloth was prepared. When the partial gel state was reached, one ply of fiberglass cloth was positioned on the mold surface and pressed firmly into the partially gelled face-coat (see Figure 1-E).

Care was taken not to rupture the resin surface, since the condition of the face-coat and first ply of glass cloth govern the quality of the tool surface. Ten minutes later the surface resin had gelled, another batch of resin and hardener was mixed together, and the dry side of the glass cloth impregnated with adequate resin to just wet the fabric. From this point the laminating operation proceeded rapidly, and each successive ply was positioned and impregnated with a minimum amount of resin. All major air-bubbles were eliminated by brush-working. The general rule, "just enough to wet the cloth," worked satisfactorily in attaining optimum resin content in the laminate.

Fig. 1. Fabrication of fiberglass laminated trim tool: A—Laminated tool as pin router template; B—Trimmed aluminum doubler with scalloped edge; C—Lifting plaster splash from master pattern; D—Building a plaster wall at the part trim line; and E—Positioning first ply of glass cloth for tool

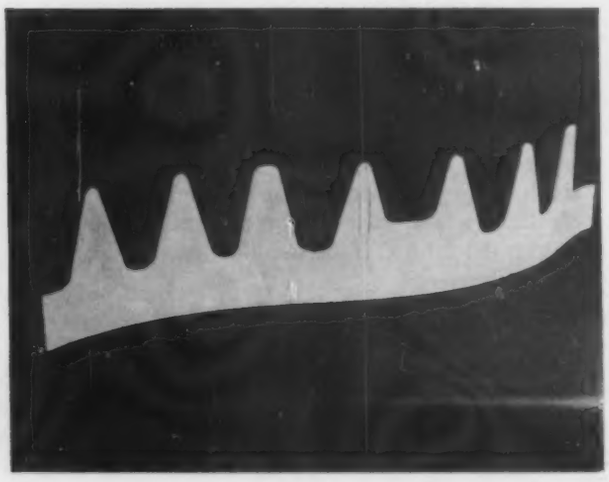


Fig. 1-A

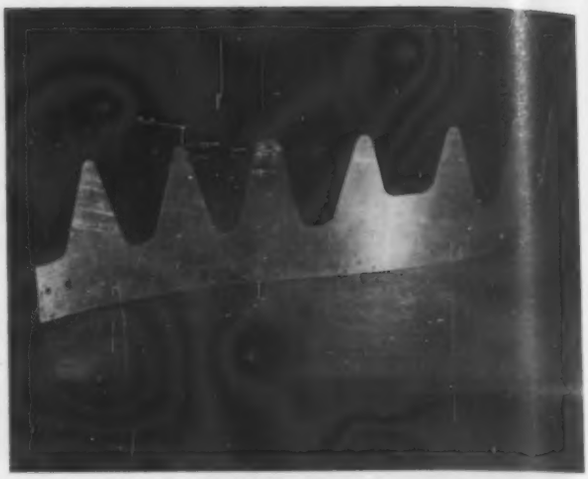


Fig. 1-B

Fig. 1-C

Fig. 1-D

Fig. 1-E

Optimum resin content in a tooling laminate is that weight ratio of resin to glass which yields a laminate of minimum warp and shrink characteristics, and maximum strength properties. Resin content in a fiberglass laminate is determined by weighing small specimens cut from the laminate, and igniting and burning off the resin at temperatures above 800° F. The resultant weight-loss is expressed as the percentage of flammable plastic in the laminate. The range of resin content for cold-set tooling laminates has been found satisfactory at 45-55%.

An indication of the resin content in completed tools can be had by taking suitable hardness readings, such as Barcol or Rockwell. Resin contents above or below the 45-55% range have been found detrimental to the physical properties of the laminate, since excessive resin results in a tool that will warp.

The old practice, known to all tool fabricators, of introducing the glass fabric into a resin-filled bucket, wringing out the excess, and building up ½-2 inch thick laminates has been replaced by the practice of attaining maximum strength with high quality thin cross-sections.

Getting back to the fabrication of the pin router template, the laminate was removed from the plaster mold 6-18 hours after completion, and cleaned. If the tool was to be exposed to elevated temperatures during its function, a heat treat cycle would have been performed. Inspection then checked for conformance to contour and dimensional tolerances, surface hardness, surface condition, tool weight, and overall uniformity of the laminated construction to assure the ability of the tool to do its job. After final inspection, the tool was forwarded to the using shop and production of parts gotten under way.

The procedure described represents the manner in which 75-80% of tools incorporating laminated fiberglass are fabricated in the aircraft industry. In exceptional cases requiring physical properties or temperature resistance not attainable with cold-set resin systems, heat and pressure are utilized to provide improved or specific properties.

Two of the advantages of the outlined basic laminating technique are the absence of external heat and pressure equipment so often utilized with conventional tooling materials, and the absence of complex or heavy machinery required to fabricate metal tools.

Materials

Elaboration upon the type or family of plastic resins utilized in the outlined basic tool fabrication method has not been given because of an ever-changing picture. The fabrication sequence should, with a few exceptions, represent the general technique of fabrication throughout the industry, regardless of the material used.

The materials initially used in laminated fiberglass, namely polyester resins with peroxide accelerators, could never be called ideal cold-set tooling resin systems. The deterrent properties of warpage, shrinkage, inconsistent curing, and tendency to delaminate have not been conducive to successful plastic tools. Although polyester resins are working satisfactorily for aircraft plastic parts, the approach to developing or choosing a particular resin system for relatively long runs of plastic parts differs widely from the approach in choosing a resin for one perfect part in tooling.

In the production of plastic parts, molds, temperatures, accelerators, etc., can be conditioned or altered to suit specific requirements; in tooling, this one part must have at hand as reliable a resin system as possible. In tooling, the economic advantage of fabrication using relatively cheap plaster molds and cold-set resin systems far offsets any other methods. This made clear the need for a better cold-set resin system.

Achievement of a cold-set resin that eliminates most of the undesirable properties of the polyesters has been realized with the development of the epoxy resin family and suitable amine hardening systems. After preliminary tests, it became evident that epoxy laminates presented much better resistance to shrink and warp during cure; that ambient relative humidity, whether 10 or 95%, was no longer a factor influencing the rate of cure of a cold-set laminate; and, most important from a handling standpoint, that the greater toughness and stronger interlaminar bond of the binder to fabric yielded longer life. In addition, the epoxies have excellent adhesive properties to paper, glass, and metal, and we have had successful use of inserts and reinforcements incorporated in the plastic tools if the inserts are correctly prepared.

However, the epoxy resins and hardeners are not trouble-free. After long, controlled laboratory tests, it was determined that ambient room temperature at the time of lamination and during the cure cycle dictated the proportion of hardener to resin to be utilized. If the temperature of the shop is controlled, a few tests will determine the optimum ratio of resin to hardener. If shop temperatures are allowed to range from 40-100° F., then a chart of hardener: resin ratios in 10-20° increments is necessary.

Before the above factors concerning temperature and humidity could be determined, thorough and absolute mixing together of hardener and resin had to be established as a standard shop practice. Because of the higher viscosity of the amine hardeners and their tendency to resist dispersion in an epoxy resin, a much longer time is required to mix resin and hardener together than was necessary with the polyester systems. The point cannot be emphasized too many times since insufficient stirring is the reason for more uncured or gummy laminates than any other factor.

In laboratory tests and shop usage, the differences among those unfilled epoxy resin-hardener cold-set systems which are currently available from all sources seem to have come about only to comply with the equipment and fabrication techniques developed within the individual aircraft plants. The advantage of using fillers at all in the resin when producing the body of the laminate is questionable. True, it does bring down the cost of the material but a poorer-quality laminate will be produced. The laminators have to be able to see those weakening air bubbles in order to brush-work them out before the cure takes place.

We have much more work to do in evaluating resins, fillers, and hardeners for tools. The use of some type of filler in the laminate gel or surface-coat may impart greater abrasion, impact, and/or surface hardness properties that application requires. Attaining the answers to the everyday problems of plastic tooling, and applying

the right material for each separate application, will come only after laboratory test under controlled conditions are performed in direct coordination with the people who design and plan tools, and with the fabricators.

Advantages and Disadvantages

There are five advantages from utilizing reinforced laminates in tooling as follows:

(1) If the tool has complex contours and would normally require metal forming, welding, straightening, etc., time will be saved in fabrication.

(2) If the tool requires manual handling during its function, the incorporation of properly-designed reinforced laminates will bring the tool weight down 25-50%. Manhours are saved during tool function if one man can handle a tool which, if made in metal, would normally require two people. Crane time, in many cases, has been eliminated by the use of plastic tooling. If the tool requires shipping to many locations, shipping costs are obviously saved.

(3) If the tool incorporates metal members that would heat-warp when welded, fabrication time can be saved by making it in reinforced laminates.

(4) The degree of flexibility in reinforced laminates has been used to advantage in applications so requiring. Hydro-pressure pads used as forming aids provide the happy medium between the rigidity extremes of rubber and metal. Precision metal tools will "ding" or bend out of shape when dropped, and this deformation may not be observed until some time after the damage occurs. Higher impact forces are required before failure of a reinforced laminate, and the damage is seen readily.

(5) An indirect saving should be mentioned, namely the relative lack of maintenance required with plastic tools. One aircraft plant spends over $50,000 per year refurbishing tool damage caused by corrosion alone.

The disadvantages of reinforced laminates evident at this time are as follows:

(1) The lack of rigidity limits applications to tools of relatively small size. The low modulus of elasticity can be overcome on smaller-sized tools by the use of suitable sandwich construction or ribbing. As the tool increases in length or bulk, these stiffening techniques become less efficient when compared with steel or aluminum on a time and weight basis.

(2) Temperature limitations of plastic tools have been a drawback. At 180° F., a cold-set epoxy reinforced laminate possesses only one-fourth of its initial room-temperature strength in flexure. This means caution in exposing tools to welding, flame overspray, elevated oven temperatures, or excessive friction.

Tooling Applications

Spot-Weld Fixtures

One application initiated as a guinea pig for plastics was a series of 22 spot-weld fixtures (see Figure 2) on one of our tooling programs. The function of the tool was to join aluminum doublers to outer flap skins. Since most spot-weld fixtures are made of aluminum in order to save handling weight, careful design had to assure an even greater saving in handling weight and fabrication time of the laminate when compared to an aluminum tool.

An unsupported mating surface 30-40 inches wide had to be ribbed sufficiently to resist deflection. Furthermore, a non-sagging beam had to be devised to mount a series of holding feet suspended above the near-center of the tool to keep doubler and flap skin in intimate contact during the welding operation.

In this entire program, it has been estimated that the handling weight of these tools, when compared to lightweight aluminum tools, had been reduced by 30%. The actual welding time was reduced by 25%, and storage costs were cut by 10%.

Keller Patterns

Epoxy laminates backed with suitable core or reinforcing materials have proved to have the same dimensional stability as gypsum materials with steel and fiber reinforcement for Keller patterns. The greater resistance of the epoxy laminated construction to handling impact, and the greater resistance of the filled epoxy surface coat to chipping or penetration by the stylus at sharp corners, has resulted in more accurate reproduction.

Figure 3 shows two Keller patterns incorporating epoxy gel coats and laminated faces with various core materials. Core materials utilized in the patterns illustrated are paper honeycomb and plastic concrete. The male and female patterns illustrated were initiated as a

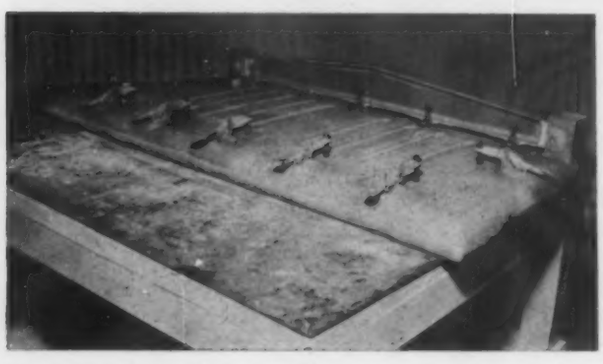


Fig. 2. 54-inch long laminated fixture for spot-welding

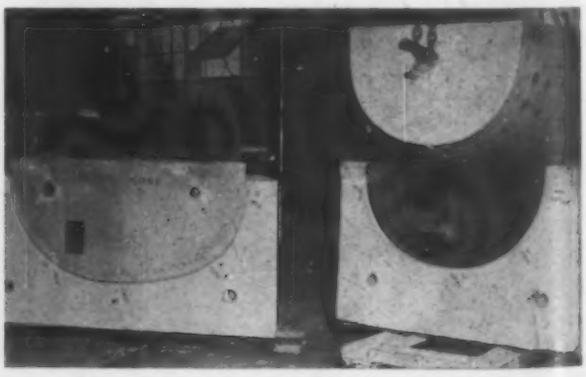


Fig. 3. Keller patterns used for dimensional stability tests

test to determine the dimensional stability of each construction when checked against its opposite fabricated in the same manner. In this particular configuration, movement of either unit would result in a gap, somewhere along the mating lines, that could be measured readily with a thickness gage. Both surfaces incorporated a silica-filled epoxy face backed with a ¼-inch laminate.

After two months aging, the matched tool with the plastic concrete core demonstrated an average separation of slightly over 0.002-inch. The pair incorporating impregnated paper honeycomb demonstrated an average separation of slightly over 0.003 inch.

Installation and Assembly Jigs

A test for comparing metal to plastic as a tool material had to do with an installation fixture for location of drilled holes prior to the attachment of radio equipment to the fuselage of one of our current aircraft. The area wherein the drilling and attachments took place was tight. A bulky, curved six-foot long aluminum tool caused difficulties in tool manipulation. The reinforced laminate tool saved only 10% in fabrication time, but resulted in a tool that was 36% lighter.

Hydropress Forming Aids

Specific applications that take advantage of the toughness and flexibility of resilient epoxy laminates have been found in Hydropress forming aids; i.e., plugs or blankets that help rubber to form aluminum into tight radii or over "rippled" contours of near-vertical draft. One example had a modified resilient epoxy resin casting reinforced with a length of one-inch fiberglass cord and backed with a 1/16-inch laminate. The fabrication was simple, only two hours were required to complete the plug, and perfect forming of the part has been achieved.

The blanket type of forming aid has reduced hand-forming on a particular series of aileron ribs, jambs, and webs by 90%. A typical aileron rib has almost vertical drafts in the crimped section. Even expensive matched metal tools thinned out or tore the thin aluminum during rubber Hydroforming. The epoxy laminate evidently spreads slightly, and then wipes the metal into the shape of the male die. Each plastic pressure pad required two to three man-hours for fabrication, and the series of 15 pads saved 44 hours of hand-forming per week during our production. The life span of the tool, depending on the shape, ranged from 200 to an indefinite number of parts.

Trim & Drill Fixtures

The application which consumes the greatest amount of reinforced laminates is the applied trim and drill-type fixture. Fabrication time of these fixtures, when compared to the cutting, grinding, or forming of metal to aircraft contours, has been diminished from 25-75%.

One application, taking fullest advantage of hand-molding, has resulted in a perfect stainless steel ring in one of our power plant sections. The ring was a 60-inch diameter piece of 0.025-inch thick stainless steel with six large depressions, and was difficult to pin down at all points, and trim, drill, and weld accurately. Within three days of fabrication time, laminated fiberglass provided an overall mating surface with 20 drill bushings. Steel reinforced the circular structure and a plug completed the mating of part and tool.

Reinforcements

The reinforcement of plastic tools is truly the backbone of their success. Initially, our tool designers had very little optimism when considering reinforced laminates because of their low rigidity, uncertain costs as compared to metal, and uncertain quality of the first part. With time and trials, they began to believe that the low-density material would ultimately save either tool fabrication time, part fabrication time, or both.

It made sense, especially in large plants, that fewer departments involved in the actual fabrication will result in less elapsed time. There is always a delay factor when a new tool enters a department for some phase of fabrication. They found that there are ways of reinforcing laminates by using newer materials in combination with the laminates themselves. To tie a structure together and yet save handling weight, it was found practical to use laminated tubing in addition to flanged construction.

Straight tubing was fabricated over mandrels such as extruded wax rods or thin sheet wax over metal tubes. A short melt-out cycle in the oven resulted in a cured tube within two hours of elapsed time. Then, a collapsible mandrel was prepared and did away with use of an oven. Current availability of straight tubes, tubular fittings, and gussets from outside sources have further decreased costs.

Contoured tubes or U-shaped reinforcing ribs integrally molded to the back side of a tool are fabricated in a number of ways. Mandrels of extruded wax are heated and formed to shape. Polyvinyl chloride plastic tubing filled with five psi. of air pressure or water, and heat-sealed at the edges, has provided another type of versatile mandrel. After completion of the laminate, a small hole drilled through the laminate into the tube releases the air or water pressure, if so desired. If the rib has an open end, the plastic tubing can be salvaged for the next tool.

A boon to contoured reinforcement has been the utilization of unexpanded aircraft-quality paper honeycomb. Procured in a thickness 1/20 or 1/40 its final expanded length, the profile shape of the mandrel may be cut on a band-saw, expanded, tack bonded into position with cold-set resins, and another type of mandrel with versatile properties becomes available.

Core Materials

Rigidity without adding any appreciable weight may be incorporated readily into a tool by use of sandwich constructions; i.e., a low-density core material with two face skins of laminated fiberglass. Figure 4 illustrates a typical nesting fixture incorporating a core of aircraft-quality paper honeycomb.

The following example illustrates one of the advantages of using low-density core materials. A reinforced laminate with a cold-set epoxy resin binder has a maximum modulus of elasticity in flexure of 2,500,000 psi. If ⅛-inch thick laminate, 6 by 14 inches was supported in a simple beam with a 12-inch span, a five-pound load at midpoint of the span would result in a deflection of

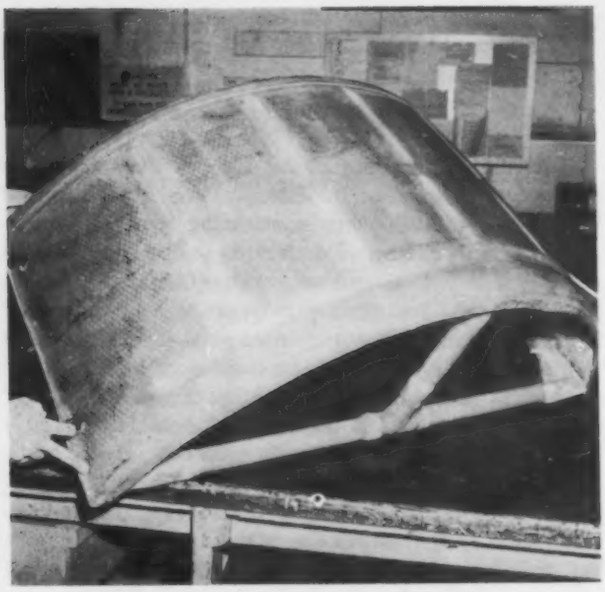


Fig. 4. Paper-honeycomb laminated nesting fixture

0.087-inch. If two reinforced laminate skins 1/16-inch thick were bonded to a one-inch thick impregnated 125-pound aircraft-quality paper honeycomb core, adding a weight increase of 40%, and spanned in the same manner as above, it would take 625 pounds to produce the same amount of deflection, and 1,500 pounds to initiate a shear failure of skin to core.

The fabrication of plastic-faced sandwich constructions will be more economical and fruitful if the following is considered:

(1) The honeycomb should have rought-cut or frayed edges at the bond line to promote the formation of resin fillets resulting in stronger bonds (see Figure 5).

(2) The laminated skins should be bonded to the core by the "wet" lay-up technique; i.e., bonding the honeycomb to the plastic face simultaneously with the curing of the face sheet itself. Pressure attained by the use of sand bags or vacuum bag has proved adequate for high-strength bonds.

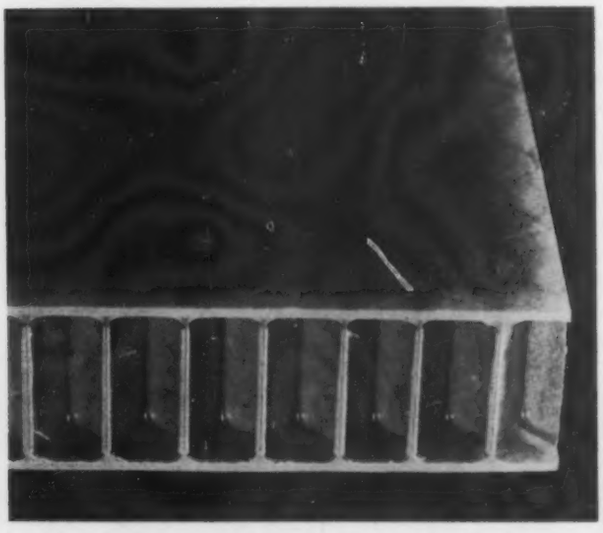


Fig. 5. Honeycomb sandwich resin fillets at bond

Tooling Industry Needs

High-temperature resins are needed that can produce high-quality laminates, with current cold-set laminating techniques, capable of retaining adequate working strength in the 200-400° F. range. Many tools now cannot be fabricated for use as molds for low-quantity production laminated parts because of the present temperature limitations of cold-set epoxy systems. Since most plastic tooling shops are geared for cold-set fabrication, the additional oven equipment, as well as the steps of plaster mold drying and incorporation of vacuum bag techniques, present economic disadvantages to using heat-cured laminating techniques.

A design handbook for cold-set tooling laminates is needed as soon as possible to furnish tool engineers with the basic working stress limits so that tools can be designed without any doubt as to their final outcome. This design handbook will not come from a single manufacturer fabricator, or even from one testing institution. It will come from laboratory tests and shop trials in all divisions of the industry, pooled and gathered together by interested associations for the good of the industry.

If your organization has not delved deeply into plastic tooling, or if it has just started, now is the time to urge assignment of project and liaison personnel to coordinate all the people involved in the fabrication of your tools. Urge standardization of materials and methods until suitable tests have proved that a new method of material warrants a change. Without standardization, the fascination of plastics breeds trial and error which, in turn, makes tool costs run rampant, and the purpose of the entire program is defeated.

Entirely new fields can be opened if the rigidity of reinforced laminates could be increased to a more competitive level with aluminum or steel. Improvement of glass fiber construction or properties, or possibly a new type of reinforcement yielding laminates with a higher modulus of elasticity, would benefit the entire tooling industry.

—The End

Welding and Powder Spraying of Plastics
(*Continued from page 477*)

smooth film. On small areas, overheating can be avoided by allowing sufficient cooling time between passes. The spraying can be interrupted by opening the by-pass valve, thus raising the temperature of the flame and reducing the suction. By judicious use of this short, high-temperature flame, the surface may be polished or glazed.

The adhesion of flame-sprayed polyethylene is outstanding, and well-adhered polyethylene cannot be removed from the base metal without tearing the coating.

Conclusions

The present success of welded and powder-sprayed fabrications is due to their service in combating corrosion. Their cost is very low when compared to the protection received, resulting in a continuously widening field for their application.

References

(1) T. C. Reinhardt. U. S. 2,220,545 to Dow Chemical Co. (1937).

(2) G. Haim and J. A. Neumann. "Manual For Plastics Welding, Vol II, Polyethylene." Industrial Publishing Co., Cleveland, O. (1954).

(3) J. A. Neumann. "Hot Gas Welding of Plastics," **Modern Plastics**, 28, 97 (1950).

—THE END

Modernizing Old Injection Machines

(*Continued from page 479*)

diameter, press condition, etc.

(9) After all the budgeted changes have been made, we recommend that a good hydraulics engineer review the entire press circuit with a view towards enlarging the restrictions sometimes made in the pilot lines of older presses to prevent hammer or pounding resulting from poor design. He also should re-set the pilot valve checks and cushions for maximum snap and speed. Such a procedure can eliminate up to one second per cycle because the spool valve and other cushions are checked only rarely, if ever, but often can be re-set to give snappier press performance.

The cost of these changes (from $2,000-5,000) is modest indeed when compared with new press cost. Results often are outstanding where the modernization program is laid out carefully, budgeted, and followed through. Unfortunately, in many injection molding shops the lack of competent help, poor understanding of mechano-hydraulic circuits, and failure to provide for adequate maintenance facilities often militates against successful completion of a program such as described above.

Nevertheless, it is quite possible to take a 10-year old press and make it definitely competitive in speed and capacity to today's best. The only argument against this modernization is that there is no way to increase the platen area. Therefore, the need for greater die space to handle larger molds is about the only justification for purchasing new injection machines, since the old ones have a lot of good work left in them if only the molder is willing to take the necessary steps to get this work.

A. R. Morse, president
Injection Molders Supply Co.,
Cleveland, Ohio

—THE END

Vinyl Calendering and Plastisol Technology

(*Continued from page 485*)

temperature would be required.

Embossing of the coated fabric may be done advantageously after the fusion operation.

Where a mineral spirits thinner has been used to reduce the plastisol viscosity, it is necessary to drive off the thinner at a temperature below the fusion temperature before the curing step itself.

Another related product made from plastisol is unsupported clear film which can be cast on a continuous metal belt. This type of product has received a good deal of attention as an inexpensive storm window.

Conclusions

Since an appreciable amount of vinyl-coated fabric is made by both the calendering and plastisol methods, it is apparent that the economics of the two processes are fairly well balanced. During 1954, about 60% of the vinyl-coated fabric made in this country was produced by the calendering method, and about 40% from plastisols or related type products.

In general, it can be said that the economics of the two processes favor the calendering method with its greater production rate where long runs and heavier coatings are involved. Where there are a number of short runs on different colors or the manufacture of lighter coatings, the plastisol method is more advantageous because there is less down-time for clean-outs, and many fewer yards of below-grade start-up material.

At this point, it appears that each process has advantages in its appropriate area so that the tendency is for the two processes to supplement, rather than replace, each other.

—THE END

Fabricating the World's Largest Hereford Bull

(*Continued from page 492*)

ation obstruction lights on the bull's back were fabricated as an integral part of the skin and the bulbs are changed from the inside. The lightning rod was installed in a similar manner to prevent leakage.

To eliminate air pressure differentials between the inside cavity and the surrounding air arising from temperature variations, two ventilators were built into the bull's feet. These vents are covered with glass fiber screens to trap atmospheric dust and dirt.

The four upright beams of the framework which extends from the legs are fastened to a steel base plate which, in turn, was bolted to the top of the pylon. The bull was hoisted onto the pylon by a 110-foot crane whose hook fastened to an eye-bolt on the internal framework. The eye-bolt is located just below a special access door in the bull's back.

The bull was erected on October 10, 1954, after a three-day road trip from North Bergen to Kansas City on a 16-wheel flat-bed trailer. The framework and lighting weighed 4,500 pounds, and the skin an additional 1,000 pounds. The skin area is about 500 square feet.

—THE END

Letters to the Editor

(*Cont'd. from page 467*)

Dear Sir:

This refers to the article, "Plastics as Capacitor Dielectrics—4. Mylar" by George Mistic, beginning on page 356 of your July issue. Items 8 and 9 of the bibliography on page 361 should refer to "Electrical Manufacturing" and not to "Electrical Engineering" as they do. Thought you might want to make this correction.

A. E. Javitz,
Special Features Editor
"Electrical Manufacturing,"
New York, N. Y.

News of the Societies

Slate Chemical Sales Clinic

"Effective Selling of Chemicals" will be the theme of the Fifth Annual Sales Clinic sponsored by the Salesmen's Association of the American Chemical Industry, which is to be held at the Roosevelt Hotel, New York, N. Y., October 24, in conjunction with the Association's annual dinner.

Four addresses will be given before the morning session of the conclave. The speakers and their subjects are Jack Klein, Klein Institute for Aptitude Testing, Inc., "Were You Born to Be an Effective Chemical Salesman?"; Robert A. Gopel, Koppers Co., "How an Ordinary Fellow Becomes a Salesman"; W. Edward Keegan, Shell Chemical Corp., "The District Office —How to Run It"; and J. Warren Kinsman, E. I du Pont de Nemours & Co., "You, the Salesman, and Your Management."

The afternoon session will be devoted to four panel discussions, running concurrently. The topics include "The Individual Salesman," "Training for Chemical Salesmen," "Administration of the District Office," and "Is Selling for Distributors Different?" A summary of the panel discussions will be given at a joint meeting afterward. A cocktail hour and dinner will conclude the day's activities. Dinner speaker will be Henry B. Hass, Sugar Research Foundation, who will talk on "What Will You Be Selling Tomorrow?"

Milwaukee Section Meets

Sixty members and guests attended the September 13 meeting of SPE's Milwaukee Section, the first meeting after the summer recess. Following dinner and a brief business meeting, the group heard a talk on "The New High Temperature Super Polyethylenes," delivered by G. H. Sollenberger of Koppers Co.

Rigidity is probably the most important of the many added features, although the new materials do retain a certain pliability. Another fact to be emphasized is that the new polyethylenes represent a group of materials, not a single product, therefore properties may be altered to suit the particular application. Super Dylan can be boiled, an important feature in the sterilization of non-breakable baby bottles.

The extent of the materials' capabilities is still an unknown factor. Many long-term endurance tests are still in process; however, all indications point to properties not to be found in any existing plastic material.

National Plastics Exposition

The seventh National Plastics Exposition, sponsored by industry and presented by the Society of the Plastics Industry, will be held June 11-15 at the new Coliseum in New York City. A trade show representing all branches of the $1½-billion plastics industry, it will feature all the latest plastics end-products as well as raw materials. Machinery, equipment, tools, dies, molds, and manufacturing processes will also be on display.

Exhibitors will include molders, extruders, laminators, calenderers, processors, converters, printers, embossers, heat sealers, stitchers, slitters, coaters, fabricators, vacuum-formers, and reinforced plastics manufacturers. More space has been contracted than for any previous showing.

A conference on plastics will be held simultaneously, featuring talks on new markets and applications. Emphasis will be placed on expanding outlets; new applications for plastic construction materials; and new processes such as vacuum forming, plastic pipe, and plastics for packaging. William C. Conroy, Erie Resistor Corp., Erie, Pa., will serve as chairman for the exposition.

Akron Polymer Lectures

The ninth season of lectures offered by the Akron Polymer Lecture Group at the University of Akron has begun. H. Mark, Brooklyn Polytechnic Institute, spoke on "Synthesis and Properties of Crystallizable Polyolefines," September 16; and C. S. Marvel, University of Illinois, spoke on "New Polymerizable Monomers Containing Nitrogen and Sulfur," October 17. The lectures are given in Room 107 of the University's Knight Hall at 8 P. M. Program chairman of the group is N. V. Seeger, The Goodyear Tire & Rubber Co.

The announced schedule of forthcoming lectures is the following:

November 4, L. H. Cragg, McMaster University, "Dilute Solution Viscosity."

December 2, W. R. Smith, Godfrey L. Cabot, Inc., "Some Recent Aspects of Reinforcement."

January 6, 1956, R. C. Osthoff, General Electric Co., "Polymerization of Organosiloxanes."

February 3, E. E. Hardy, Mobay Chemical Co., "Polyurethanes, A New Plastic Technology."

March 2, W. O. Baker, Bell Telephone Co., "Polymer Carbon."

April 13, H. G. Cassidy, Yale University, "Preparation and Properties of Electron Exchange (Redox) Polymers."

Rheological Meeting Scheduled

The Society of Rheology will hold its annual meeting at the Henry Hudson Hotel, New York, N. Y., November 2-4, with 20 papers scheduled for presentation on a wide range of pertinent subjects, including four to be given Friday morning, November 4, on the rheology of polymeric materials. Discussions on the plasticity of metals, flow phenomena in geological studies, hypoelasticity, and determination of dispersion structure by viscometry will compose the remainder of the agenda. Programs and further details may be obtained from F. D. Dexter, Bakelite Co., Bound Brook, N. J.

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Automotive Engineers Meet

The West Coast golden anniversary meeting of the Society of Automotive Engineers was held at the Hotel Multnomah, Portland, Ore., on August 15-17. A number of papers were presented at the meeting, some pertaining to the plastics field. Summaries of these papers follow:

"Automotive Applications for Zytel Nylon Resin." John D. Young, polychemicals department, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. The importance of molded nylon as an automotive engineering material stems from its excellent combination of properties, and from such economic advantages as rapid mass production and lightness of weight. Mechanical strength is illustrated by its use in a passenger car door-lock wedge. Nylon's resiliency is brought out by its damping of door vibrations, and the no-lubrication feature eliminates the possibility of stained, greasy clothing. Greater latitude in design is possible, since close tolerances are not required.

Other applications for nylon include the front seat back stop, noiseless gears, brake pedal bushings, window regulator roller, and the automatic transmission selector panel. Nylon performs heavy-duty jobs also, forming the eight main hanger bushings and 16 shackle bushings in a torsion bar, tandum axle trailer. In this particular application nylon bore loads up to 1,800-2,000 pounds per square inch. Nylon bushings have been used in the brake camshaft assembly, and its heat and electrical resistance permits its use in coil forms, bearing retainers, fuse holders, voltage regulator bases, and the windshield wiper motor.

"Plastic Bodies Can Be Repaired." Henry Jennings, Fleet Owner, Strick Trailer Co., intentionally damaged a glass fiber-reinforced polyester panel to demonstrate the material's ease of repair. An area extending 12 inches in all directions from the break was thoroughly cleaned with a standard solvent. Sanding about six inches around the fracture is required, with greater pressure exerted at the hole to produce a Vee or scarf. Glass cloth patches are cut, the first overlapping the break by about two inches. The number needed depends upon the thickness of the panel, one being required for each 25 mils.

Resin is then mixed and added in about the ratio of 2:3, painting successive coats over each patch. A sheet of cellophane is laid over the injured area and smoothed out with a squeegee. This is allowed to remain while a smooth pressure plate is applied for about an hour. Further sanding should compensate for any shortcomings; however, more resin and power-tool buffing are needed to produce a sheen.

"Design Factors to Be Considered." Woldemar Schultz, Ford Motor Co. The problem of how to design to take advantage of this new material (reinforced plastic) was discussed in terms of comparative ratings of material costs as against weight, curves of constant flexural and tensile strength, buckling, and compression. Integration (using diecasting shapes and primary bonding) allows strength where needed; permits weight saving; enhances strength through continuity of structure; reduces deflection under load through increased fixity of joints; and eliminates rivets, bolts, and sundry fasteners while also reducing dimensional coordination problems. Finally, in considering the passenger car body, a complete stress analysis of steel and plastic body deflections can and should be made for comparative purposes.

"Properties of Glass Fiber Reinforced Plastic." John G. Coffin, Chevrolet Motor Division, General Motors Corp. Available engineering data covering the mechanical and physical properties of reinforced plastics as a structural automotive material were reviewed. The discussion was limited primarily to molded panels containing approximately 40% glass, 15% filler, and 45% resin. Mechanical properties, with the exception of compressive strength were found to increase in direct proportion to the glass content and comparisons were based on 20-gage S.A.E. 1010 steel as opposed to 0.100-inch thick plastic. Most of the reinforced plastic supplied to the automotive industry is about three times as thick as the steel it replaces, though only one-half the weight. Trebled thickness compensates for the greater strength of steel in terms of psi., and the crux of the plastic problem actually involves a compromise between stiffness and resilience. Eight charts comparing properties of steel and plastics were included, and it was pointed out that these new engineering materials have a permanent, ever-broadening place in the automotive industry.

"Glass Fiber Reinforcement." C. E. Hoover and Ralph Sonneborn, Owens Corning Fiberglass Corp. Glass fibers as reinforcements for plastic offer greater mechanical strength than bulk glass. Chopped strands, rovings, non-woven reinforcing mats, milled fibers, yarns, surface and overlay mats, woven fabrics, and rove cloth are formed from a lime-alumina-borosilicate glass that is relatively soda-free. Commonly referred to as "E" glass, the fibers make possible great design latitude, as well as variations in strength, rigidity, cost, production methods, and directional characteristics. Individual filaments are available in several diameters from 0.0002-0.001 inch, and are said to possess a tensile strength of about 400,000 psi., regardless of diameter. Manufacture of the basic fiber and glass surface treatments were also discussed in detail.

"The Development of Reinforced Plastics in Commercial Vehicles." Stanley S. Wulc, Consultant. In order to grow, the reinforced plastics industry must have an abundance of supervisory personnel, raw material quality control, finished parts control, and developmental research laboratories. Plastic elements have gradually been introduced in trailers, as doors and liners for refrigerated equipment, skylights, and plastic side panels, which have finally led to an all-plastic body.

Price is often mentioned as a deterrent to the widespread use of plastics for ordinary-type trucks. While it is true that aluminum and steel are cheaper materials, the price of plastic tooling for steel is approaching that of steel tools for reinforced plastics. Plastics are a must for conveying corrosive chemicals, and certain fleet owners find it profitable, advertising wise, to have plastic trucks molded in identifying shapes.

Name TAPPI Plastics Committee

TAPPI, the Technical Association of the Pulp & Paper Industry, will hold its National Plastics Meeting in Brooklyn, N. Y., on November 14 and 15, 1955. Theme for the meeting is "Fibers and Plastics for Laminates," and the following committee members have been appointed by J. C. Pullman, chairman of the group: general chairman, H. F. Mark, Polytechnic Institute of Brooklyn; technical program chairman, W. L. Hardy, Foster D. Snell, Inc.; and local arrangements chairman, R. Lindenfelser, American Cyanamid Co. Mr. Pullman and V. C. Stannet, chairman and secretary, respectively, of TAPPI's plastics committee, are also members of the National Meetings Committee.

SPI Pacific Coast Section To Cruise Hawaiian Islands

The annual meeting of the Pacific Coast Section, SPI, will open with technical meetings at the St. Francis Hotel, San Francisco, Calif., on March 28. Later in the day the delegates will board the Airline for passage to Hawaii, during which time meetings will be covering topics of interest to management, administrative, and production personnel. April 2-7 will be play time, with the annual business meeting scheduled for one day only.

Registration fee for the conference will be $15, which covers all Society-sponsored meetings. Minimum price for the round trip and all shore activities is $570 plus tax. An initial deposit of $50 should accompany applications for space, and cabin assignments will be made on a first come, first served basis. All inquiries should be addressed to SPI Transportation Committee, 18 North First Ave., Arcadia, Calif.

NEWS of the INDUSTRY

Epoxy Resins Cut Die Costs

Savings up to 50% have been obtained by Teicher Mfg. Co., Flushing, N. Y., using Marblette epoxy resins to cast drop hammer dies instead of the lead and kirksite tooling formerly used. These savings are not based on material costs alone, but rather on such factors as speed in making and renovating the tools, elimination of shrinkage, and reduction of finishing time.

Since the weight of the punch is not a controlling factor on power presses such as the Ceco stamp, Teicher has found the durable plastic dies to be particularly applicable. One operation calls for dies to form blanks of 0.064-inch aluminum. The plaster mock-up can be made from loftings, and need not be oversized. Marblette #614 was poured into the plaster mold after the retaining wall was fitted and coated with parting agent. Oven cure followed according to specifications. The aluminum-filled epoxy die then was utilized to cast the punch.

With a surface casting resin such as Marblette #618, a lead core was suspended in a predetermined amount of resin to obtain a ¾-1 inch face. Wax lay-up was used to form metals of greater thickness. On the Ceco press, as many as 250 pieces were run before erosion required refacing. This refacing operation was accomplished in about four hours.

General, Respro to Merge

The General Tire & Rubber Co., Akron, O., will ask its stockholders on October 10 to approve the merger of Respro, Inc., Cranston, R. I., into General's plastics operations. With the necessary majority of Respro stockholders already having approved the proposed arrangement, the merger appears to be a foregone conclusion.

Under the terms of General's offer, the basis of the merger would be an exchange of 6¼ shares of Respro's capital stock for one share of General's 5% Cumulative Preference stock, $100 par value. Respro and its subsidiaries, which include United Lace & Braid Co., Lion Products Co., and United Chemicals, Inc., manufacture shoe materials, electrical tapes, insulation, and various types of fabrics, such as impregnated, coated, woven, unwoven, and rubberized.

Upon final approval of the merger, Respro would be operated as a division of General Tire under the present Respro management, according to William O'Neil, president of General Tire.

Molds Impact Phenolic Doors

Scratch resistant impact-phenolic doors are now standard equipment on all models of Leeds and Northrup's new Speedomax H recorders, controllers, indicators, and Series 60 control units. Compression molded by Auburn Button Works, Auburn, N. Y., the instrument doors feature a high strength-to-weight ratio and a "built-in" finish which requires no additional finishing or touch-up.

Strengthening ribs, chart and control openings, and groove for a gasket are all provided in the mold design. Tappings for door hardware and the application of door front decal are performed by the molder.

Reichhold Opens 34th Plant

A new plant for the production of Plyophen liquid and powdered phenolic resins has been opened by Reichhold Chemicals, Inc., in Kansas City, Kan. Occupying an eight-acre site, the unit includes a refrigerated warehouse as well as a laboratory-office building. Future plans call for construction of a formaldehyde plant and, eventually, manufacture of RCI's full line of chemicals and resins.

The Kansas City facility is expected to supply raw materials easily and conveniently to local manufacturers of fibrous glass-resin products. L. C. Brandt will serve as plant manager, and A. L. Wooten as technical director.

Installs Laminating Equipment

Laminating and coating equipment, reportedly capable of producing roll or sheet widths up to 54 inches and gages from 0.00025 up, has been installed by Gomar Mfg. Co., Newark, N. J. Intended primarily for custom production, the machines will laminate foil to plastic or paper, plastic to plastic, polyethylene to cellophane, and vinyl to cloth, as well as coat with heat-sealing adhesives.

The new equipment is said to operate at phenomenal speed, and with economy of operation. Packaging firms and others are invited to submbit specifications for estimate and quotation, without obligation.

UCC to Erect Skyscraper

Union Carbide & Carbon Corp., New York, N. Y., will erect a 41-story building on the entire block between Park and Madison Avenues, and 47th and 48th Streets, in New York City, to house the home offices of itself and its divisions and subsidiaries. More than 3,000 of the firm's employes will be assigned to the new structure.

Cost of the proposed building is estimated at 40 million dollars, and occupancy is scheduled for some time in 1958. The New York Central Railroad holds an option on the block-square midtown site, which Union Carbide will purchase. The building will be designed by Skidmore, Owings & Merrill.

Buys Plastic Hose Firm

American Hard Rubber Co., New York, N. Y., has announced its purchase of the assets of Industrial Synthetics Corp. and its subsidiary, Supplex Corp., both of Garwood, N. J., manufacturers of plastic lawn sprinklers and garden hose.

Albert A. Kaufman, president of Industrial Synthetics, will remain in an active executive capacity, and will also join the management group of American Hard Rubber as a consultant to expedite development plans of the company, according to V. T. Norton, president of American Hard Rubber.

New Rohm & Haas Laboratory

A new plastic research and development laboratory has been built by Rohm & Haas Co., at its Bristol, Pa., plant to house the firm's design staff, customer service groups, and plastics research personnel. A large chemical laboratory for high-polymer research, and a cast sheet semi-works for evaluation limited production of experimental compounds are also included in the 14,500 square foot structure.

Architecturally, the building serves as a showcase for the company's acrylic plastic products. Plexiglas is used for daylight-control glazing, and as a diffusing medium for large-area lighting. Extruded sheets suspended in an unconventional semi-tubular pattern form a luminous ceiling which reportedly provides high quality lighting at low cost.

The main entrance, as shown in the accompanying photograph, is flanked by translucent awnings of V-rib Plexiglas which control heat and glare. These are supported by square aluminum tubing. Company engineers were responsible for the mechanical design, and the Rohm & Haas engineering department served as general contractor.

Rohm & Haas plastics lab features acrylic glazings

Plant Maintenance Confab

The 7th annual Plant Maintenance & Engineering Show and Conference will be held in Convention Hall, Philadelphia, Pa., January 23-26, 1956, and it is expected that about 400 exhibitors and 2,500 engineers will participate, according to Clapp & Poliak, Inc., New York, N. Y., producers of the event.

The steady trend toward automation in American industry has increased the importance of the affair, since the workman who formerly operated the machine now maintains it. Further details may be obtained from Clapp & Poliak at 341 Madison Ave., New York 17.

Purchases Bolta-Carpart

Don R. Mitchell, president of Mitchell-Bentley Corp., recently headed a group which purchased complete control of Bolta-Carpart, Inc., Owosso, Mich. The firm, which will be known as Mitchell Plastics, Inc., manufacturers molded plastic parts for the automotive, refrigeration, radio, television, and packaging industries.

William F. Mitchell has been elected president of the new corporation; B. M. Triggs, executive vice president; Scott Walker, vice president and general manager; Thomas S. Drabek, vice president and sales manager; and Clyde N. Wilson, secretary and treasurer.

Vinyl-Fabric Combinations Offer Production Economies

Vinyl sheeting backed with nonwoven fabric materials is said to offer numerous economies for such automotive upholstery items as door paneling, scuff pads, and seat bolsters. The nonwoven fabric provides strength and support to the exterior vinyl sheet, and eliminates the need for heavier and costlier backing materials.

According to H. R. Thies, general manager of Goodyear Tire & Rubber Co.'s chemical division, the firm's Chemigum latices are used in the manufacture of nonwoven fabrics to bind the fibers and give equalized strength in all directions. He cited Lantuck, a product of West Point Mfg. Co., West Point, Ga., as typical of the nonwoven materials now being used in the late-model cars. The fabric is welded electronically to the vinyl sheet, which is the only material visible after installation.

Another combination of latices, Chemigum and Pliovic, is said to give better abrasion resistance and tensile strength to fabrics, as well as superior adhesion and oil, grease, and solvent resistance. The resultant coated materials have been used for packaging, rug backings, and binders.

Fiberglass-reinforced plastic panels form spire over rocket swings at amusement park.

Amusement Center Displays Use Fiberglass Panels

Because of their decorative beauty and resistance to punishment, translucent fiberglass-reinforced plastic panels made by Alsynite Co. of America, San Diego, Calif., have been found ideal for use in various concessions at the Forest Park Highlands amusement center, St. Louis, Mo. Approximately 1,500 square feet of Fiesta Series 150 Alysnite panels were used for the installations.

Included in the displays were an inside-lighted spire of red and yellow panels over the rocket swings (see accompanying photograph), and white and green backdrop panels for the water pistol shooting game. In the latter application, the plastic panels neither warp nor require painting despite their being wet down continuously.

Polyethylene Watering System

Extruded polyethylene tubing supplied by Bakelite Co., New York, N. Y., is being used in a new greenhouse watering system developed by Greco's Greenhouses, Middletown, Conn. Light in weight and extremely durable, the installation reportedly pays for itself within six months in terms of labor cost savings.

Accurately spaced holes are punched in the tubing, the angle determining the direction of flow. Water under pressures as low as one pound per square inch is used to irrigate greenhouse benches up to 100 feet in length. Black polyethylene is used to prevent the penetration of light, thereby preventing the growth of algae and assuring free flow. Chemically resistant, the tubing may be used to deliver liquid fertilizers to the plant roots.

Supplied in compact rolls, the tubing can be installed within a few minutes. Equipment for watering a 100-foot carnation bench is estimated to cost less than half as much as labor to hand water it for one year.

Dow Aids Technical Education

More than $300,000 has been allotted by Dow Chemical Co., Midland, Mich., to colleges and universities for the advancement of science and engineering during the academic year 1955-1956. According to Dr. Leland I. Doan, Dow president, the firm feels that industry has an obligation to society to help support education as an important instrument in industrial and cultural progress.

Approximately one-third of the allotment is earmarked for the establishment of graduate fellowships and undergraduate scholarships for deserving students. Another third goes toward expansion of the schools' operating programs, and the remainder is intended to finance specific research projects. Recipients are chosen in all cases by the fellowship committees of the various schools.

Australian Reps

Australia will soon be producing Campco thermoplastic sheeting, including GM high gloss modified styrene, under license from the Campco Division, Chicago Molded Products Corp., Chicago, Ill. Moldex, Ltd., of Melbourne, will manufacture the sheets which will be marketed through Mulford & Co., Pty. Ltd. The latter firm maintains offices in both Melbourne and Sydney.

The licensing arrangements include the interchange of technical information on methods, processes, and machinery. Australian personnel will be trained here in manufacturing and merchandising methods.

Builds 29-Foot Plastic Boat

The Dyercraft "29" Sport Fisherman, said to be the first 29-foot plastic boat to be built on a production basis, has been constructed by Anchorage Plastics Corp., Warren, R. I. The boat is made of the company's Dyeresin processed fiberglass and polyester resin. Anchorage built the first 36-foot LCVP's for the Navy in 1946, and in 1950 built a 42-foot auxiliary ketch that is claimed to still be the largest one-piece plastic hull constructed to date. Other experience by Anchorage includes the building of 40-foot utility boats for the Coast Guard and 33-foot auxiliary sloops. From its experience and that of its customers, Anchorage is convinced that boats of moderate size can be built successfully of reinforced plastics, and that such boats give more satisfactory service than those made of previously-used materials.

Dyercraft boat made of fiberglass-reinforced polyester.

Petrothene Resin Grades

A realignment of grade numbers on its Petrothene polyethylene resins has been announced by U. S. Industrial Chemicals Co., New York, N. Y. Resins have been grouped into 100, 200, and 300 series which are available from the company's plant at Tuscola, Ill., and from warehouse points at Anaheim, Calif.; Chicago, Ill.; Cincinnati, O.; Jersey City, N. J.; and New Orleans, La.

Two resins are in the 100 series which is designed for applications demanding outstanding properties. These resins are: Petrothene 100, a film-grade resin of good transparency and medium flow, for use in tubular film extrusion and blow molding and Petrothene 110, a film-grade resin of good transparency, superior slip properties, and medium flow, for use in tubular and sheet film extrusion.

The 200 series, intended for general use, consists of the following five resins: Petrothene 200, an all-purpose molding and extrusion resin that is particularly suitable for making film and small molded parts; Petrothene 201, a medium to high flow resin for molding, extrusion, paper coating, and blow molding; Petrothene 202, a high flow resin for coating applications and the injection molding of large parts; Petrothene 203, a medium to high flow resin for paper coating and injection molding of parts stiffer than those obtained with 202; and Petrothene 210, a resin of good transparency and superior slip properties for sheet film extrusion.

The 300 series is especially adapted to wire covering and electrical insulation applications.

Produces Isocyanates in Canada

Robinson Collo Canada, Ltd., a joint enterprise of Robinson Cotton Mills, Ltd., and the American Collo Corp., Ridgefield, N. J. has undertaken the manufacture of Collo Allfoam at Woodbridge, Ont. A versatile synthetic foam based on polyurethane, Collo Allfoam has been manufactured in the United States by the American Collo Corp., and will be produced in Canada under a license granted by Mobay Chemical Co.

The Woodbridge plant is expected to be in full operation by the end of September, supplying foam in a variety of densities, pore structures, sizes, and shapes. Continuous slabs averaging 20 yards in length have been produced by the U. S. outfit in thicknesses to eight inches, and widths up to 54 inches. Densities vary from 2-10 pounds per cubic foot. The thermal insulating power shows a K factor of about 0.033 Kgs. cal/Mh°C., twice that of cork.

American Collo was an offspring of Collo-Rheincollodium GmbH, the German company which pioneered polyurethane foams in Europe. Rolf Moroni, who introduced the foam on the market, is actively connected with the American firms which, therefore, are in a position to draw on the accumulated experience of seven years extensive research and development.

New Durez Plant Operating

Production of Durez phenolic molding compounds has begun at the new $5,000,000 Kenton, O., plant of Durez plastics division, Hooker Electrochemical Co., Niagrara Falls, N. Y., according to John F. Synder, Sr., Hooker vice president.

The plant is completely modern and employes unique automation techniques, Mr. Snyder said. Phenol and formaldehyde, the raw materials of the phenolic molding compounds, are supplied by Hooker's North Tonawanda, N. Y., plant. The molding compounds are sold to custom molders and to manufacturers.

Hoover Vacuum Uses PVC Parts

Eight different parts on the Hoover Co.'s new Model 82 vacuum cleaner are made from B. F. Goodrich Chemical Co.'s Geon vinyl resin, reportedly offering numerous advantages over previous models. The Ultraflex hose combines 100% extensibility with much better aging qualities than the regular fabric-type hose, and can be cleaned with a damp cloth.

The vinyl furniture guard serves a dual purpose, acting as a decorative bumper strip and as an air-tight seal between the two halves of the container. Vinyl litter pickers replace bristle brushes, offering longer life and ease of cleaning. The four nozzles, hose grips, and the extension tube gasket also consist of Geon. Greater economy was possible with PVC, due to its shorter molding cycle.

Baker Brothers Expands

Increased demand for its newly designed 50-, 75-, 100-, and 150-ton automatic compression presses has necessitated the securing of larger facilities by the plastic press division of Baker Brothers, Inc., Toledo, O. The new quarters at 1000 Post Street reportedly permit closer association between sales and engineering, allow increased production, and permit expansion.

Baker's new presses are said to be the first completely new compression automatics introduced to the plastics industry in several years. The firm also manufactures standard and special machine tools.

New Battelle Chem Building

A $1,400,000 chemistry building has been added to the facilities of Battelle Memorial Institute, Columbus, O. The four-story red brick structure now houses seven of the nine divisions of the department of chemistry, as well as one engineering division, and gives the Institute about 50% more laboratory space for chemical research.

In addition to laboratories for organic, inorganic, analytical and physical chemical research, specialized facilities are provided for rubber, plastics, coatings, paper, leather, and lubricant technologies, the Institute says. Areas for plastics and rubber processing and for chemical engineering pilot-plant studies are also available.

Sierra Electric Corp.'s new facility in Gardena, Calif.

Sierra Opens Gardena Plant

Consolidation of five different operations has been accomplished with the opening of Sierra Electric Corp.'s new plant at Gardena, Calif. The firm, which manufactures electrical devices, plastic products, and electronic components, hopes to triple its productive capacity as well as provide for enlarged research and engineering departments.

The facility is located on a 10-acre site just southwest of Los Angeles, abutting the projected Harbor Freeway. The two-story office building is separated from the main factory building by a spacious patio area. A separate building houses the boilers, pumps, and heavy power equipment, with utilities entering the factory below the floor level. Fluorescent lighting, power ventilation, and an automatic fire-protection system have been installed.

The company, founded in 1918, is reportedly the Far West's pioneer plastics molder. Warehouses are maintained in Chicago, Atlanta, and New York, and representatives are located in all the major cities and abroad.

West Coast Chemical Boom

"The West, California in particular, is destined to play a big role in chemical and plastics processing," according to John L. Gillis, vice president of Monsanto Chemical Co., St. Louis, Mo. "Monsanto has invested about $10,000,000 for expansion in the state of California alone in the past four years," he continued, "and we do not intend to reverse our gears."

Monsanto has been active on the coast since acquiring I. F. Laucks, Inc., Seattle, Wash., in 1944. The firm, a leading manufacturer of plywood adhesives and surface coatings, also maintained a small plant in the Los Angeles area. In 1950, Monsanto built a plant at Long Beach, Calif., for the production of styrene molding compounds; and began another unit in Santa Clara for the manufacture of resins and surface coatings.

Chemical industry employment shows a 20% gain in the last four years. Nearly every major chemical manufacturer has located at least one plant in California, since the chemical industry is its own best customer. Petrochemical production is on the increase, and the chemical industry is finding more of its raw materials in the oil fields.

Monsanto is the sole exhibitor among chemical firms at Disneyland, Calif., where a Chemitron symbolizing the eight basic raw materials of manufacturing occupies the center of the exhibit. The exhibit attempts to tell the story of chemistry in terms of material progress. Wall displays depict the manufacture and use of plastics, and numerous plastic items are on display and being tested for wear by the more than 5,000,000 visitors expected annually.

Holiday Absorbs Thermacote

Thermacote Plastic Products, Inc., and Thermacote Mfg. Co., both of Newark, N. J., have become a wholly owned subsidiary of Holiday Plastics, Inc., Kansas City, Mo., and will be known as the Thermacote Division of that corporation. The consolidation will reportedly increase production capacity and place the firm in a better position to manufacture point of sale items.

George K. Frischer is the new president of the over-all operation, with Robert Vaillancourt remaining president of the Thermacote division and Richard Vaillancourt, vice president in charge of sales.

Extruder-Sales Outfit Expands

Typifying the growth within the plastics industry, Jet Specialty Sales Co., Los Angeles, Calif., has expanded during the past ten years from a one man organization in a two-car garage to include an extrusion plant, a compression and injection molding plant, a tool and die shop, and a polyethylene fabrication unit.

New additions are planned for the recently-opened extrusion plant, which now operates from 16-21 shifts of eight hours per week. All material produced by Flek Corp., its molding subsidiary, is shipped and invoiced by the parent firm. Jet also maintains controlling interest at Beacon Bag Co., which converts Jet's extruded polyethylene tube into bags and containers.

Mold (right) and finished plastic float (left) developed at Naval Research Laboratory, Washington, D. C., for underwater experiments in submarine detection. Molded from Koppers' Dylite expandable polystyrene, the float is practically unsinkable, weighs only 42 pounds, and can support a weight of about 800 pounds afloat.

Employs Polyethylene Closures

Temporary window coverings of polyethylene film enables construction work to continue during extremely inclement weather, according to a number of architectural and contracting sources. Bakelite polyethylene processed by Visking Corp., Terre Haute, Ind., proved successful in blocking winds up to 65 miles per hour, and permitted brick to be laid on snowy days by holding-in heat from gasoline-burning hot air heaters.

Calabro Construction Co., Linden, N. J., used approximately 11,000 square feet of four-mil Visqueen film for a temporary closure on one construction job scheduled for the winter months. Translucent, the film provided adequate daylight and eliminated the need for installing an elaborate temporary lighting system. Supplied in 100-foot rolls, 13 feet wide, the film is available at about the same cost as special types of kraft paper currently used.

Baseball Utilizes Vinyl Tarp

New rain tarpaulins for the New York Polo Grounds are made of Krene, Bakelite's vinyl plastic, at about 40% of the cost of other covers of comparable light weight and durability. Moisture resistant, the material will not mold or mildew.

The tarpaulin is flexible and easy to handle; seven men can cover the entire infield in three minutes and ten seconds. Weighing approximately 12 ounces per square yard, it is fabricated by laminating two sheets of Krene over a layer of nylon mesh.

Known as Nyvel, the material was developed by Velveray Corp., New York, N. Y., and is available in several weights for different applications. Whether joined by heat sealing or stitching, the sheets are reportedly effective in shielding agricultural, industrial, and marine equipment from wet weather.

Falls Engineering Builds On

A plant expansion program which will double production, engineering, and office space is being undertaken by the Falls Engineering & Machine Co., Cuyahoga Falls, O. An 80-foot frontage south of the present unit has been purchased, and a one-story brick building has already been erected for occupancy by the engineering offices of Campbell Machinery Development Co. The latter firm designs FEMCO-Built machinery for plastics and rubber manufacturers.

A new addition will house the shipping and receiving departments, the paint and carpenter's shop, and material storage. Space formerly occupied by Campbell has been diverted to assembly of heavy machinery, and to shop and office space. Falls Engineering entered the manufacturing field with a line of molded V-belts, and has expanded to machinery such as splitters, cushion cutters, and die cutters.

In Brief . . .

Synthane Corp., Oaks, Pa., manufacturer and fabricator of laminated thermosetting plastics, has announced the removal of its Rochester, N. Y., sales office from 1013 Genesee Valley Trust Building to 137 West Commercial St., East Rochester, N. Y.

Monsanto Chemical Co.'s organic chemicals division, St. Louis, Mo., has announced that its di-isooctyl phthalate was approved by the Food and Drug Administration as non-toxic. Films prepared with Monsanto's DIOP are approved for wrapping foods having a high water content.

E. I. du Pont de Nemours & Co. Inc., Wilmington, Del.'s employe magazine, "Better Living," has stated that synthetic fibers, antibiotics, and synthetic plastics take top rank as the most useful chemical developments of the last 35 years. The authority for this statement, which appeared in the May-June issue, was a survey by a panel of nine experts in the fields of science, education, and publishing, who were asked to make the selection to mark Chemical Progress Week, May 16-21.

Atlas Powder Co., Wilmington, Del., has awarded to eight top chemistry and engineering students scholarships of $1,000 for their senior year in college. In addition, the students will be given a chance to gain practical experience this summer by employment in one of Atlas' explosives, chemicals, or activated carbons plants, or in the firm's research laboratories.

Molded Products Division, Admiral Corp., has announced a change in address from 4533 West Harrison St., Chicago, Ill., to P. O. Box #338, West Chicago, Ill.

Synthane Corp., Oaks, Pa., received an honor award for maintaining a no-lost-time accident record during the recent Inter-Plant Safety Achievement Contest sponsored by the Philadelphia Safety Council of the Chamber of Commerce. One hundred and sixty-one companies in the Greater Philadelphia area participated.

Hooker Electrochemical Co., Niagara Falls, N. Y., has announced that three Hetron fire-resistant polyester resins have been given temporary approval by Wright Air Development Center, Dayton, O., for use in military and civilian aircraft components.

Monsanto Chemical Co.'s plastics division, Springfield, Mass., has designed and built a four-room exhibit demonstrating the use of plastics in the home. The display, called "Monsanto Plastics Festival," was featured May 9-23 at Famous-Barr's department store, St. Louis, Mo.

News from Abroad

Plastics in Argentina

Phenolic molding powders are the principal plastics materials currently being produced in Argentina, with four primary and five small manufacturers. Production reached 1,600 tons in 1954, the third successive year showing an increase. Maximum potential is estimated at 3,600 tons annually.

Three firms produce urea molding powders and, although exact figures are not available, annual production has been estimated at 500 tons by trade sources. The country's capacity is much higher than indicated, having been restricted by competition with lower-priced imported products. About 100 tons of urea-melamines are produced annually by one firm, largely for the textile industry.

Three Argentine companies produced approximately 400 tons of phthalic alkyds and 200 tons of maleic alkyds in 1954, practically all of which was consumed by the paint industry. Casein plastics are being manufactured, but no statistics are available.

Plans have been drawn for the manufacture of newer materials, and the government has approved two projects for manufacturing polystyrene and polyethylene film. Vinyl materials are currently under consideration. With respect to molding, compression predominates with 500 firms of all sizes existing throughout the country.There are also 100 injection molders, 18 extruders, and two firms for calendering film.

Low Pressure Polyethylene

Of all the plastics exhibited at the Hanover Industrial Fair in Germany from April 23 to May 3, 1955, probably none drew more attention than Hostalen, the low pressure polyethylene produced by the Farbwerke Hoechst, A.G., Frankfort a.M., by the Ziegler process and shown for the first time in various applications. There were foils, tubes, pipe, and household molded articles made by extrusion and injection molding. Hostalen can be produced in bright colors by the incorporation of inorganic pigments and, because of its relatively high dimensional stability and rigidity, can make thin-walled bottles and hollow goods that are sterilizable at temperatures up to 110° C. The material is expected to find wide use as sheathing for cables, pipe for conveying cold water, and in coating and lining objects by the whirl-sintering or flame-spraying processes.

Hostalen, which is produced in the form of a powder, is claimed to be more wear-resistant and rigid than high pressure polyethylene, and also has a higher molecular weight, higher degree of crystallinity, and higher softening point. According to provisional data, it has specific gravity of 0.94; melting range of 128-135° C.; tensile strength of 190-210 kg. sq. cm.; elongation of 300-800%; indentation hardness (steel ball 5 mm. in diameter, pressure 25 kgs., at 20° C. for 10 or 60 seconds) of 301-341 kg. sq. cm.; and dielectric strength of about 60 kv./mm. It can be used within a temperature range of —30° to +80° C. under mechanical stress.

French Silicone Production

The French Societe Rhone-Poulenc has been operating its large new silicone factory, the first in France and the most important in Europe, located near Saint-Fons (Rhone), for about a year now. The company first became interested in silicones in 1943 when investigations were quietly carried out so that samples of silicones could be submitted to certain industries in France by the end of 1945. The first patent was applied for in March 1946 and manufacture started soon thereafter. Subsequently, arrangements with American concerns enabled Rhone-Poulenc to improve its process. Before long, it became clear that a separate and independent factory, with its own research department and testing laboratories was necessary, and "Les Carrieres," as the new silicone undertaking is called, was established.

Joint Production Enterprise

In connection with the above, the Kohle-Ol-Chemie G.m.b.H. has recently been established at Gelsenkirchen, Germany, as a joint enterprise for research and development in olefine chemistry, with the purpose of producing plastics from olefines based on coal and petroleum. The founder firms, from the German petroleum steel and chemical industries, respectively, are the Deutsche Erdol A.G., the Mannesmann A.G., and Farbwerke Hoechst, who have equal shares in the capital of 15,000,000 DM. A factory is to be built for the production of polyethylene by the Ziegler process which is expected to begin operating in the spring of 1957 with an initial annual output of 24,000 tons.

Non-Toxic Tin Stabilizers

The use of dibutyl tin compounds to stabilize PVC is limited by the fact that they are toxic to sime extent. Investigations carried out at the Institute for Organic Chemistry T.N.O., Utrecht, Netherlands, and by certain organizations, have shown that this toxicity is a property chiefly of the lower alkyl tin compounds, and decreases rapidly when alkyl groups are lengthened to more than four carbon atoms. The Utrecht institute and the Plastics Institute T.N.O., Delft, collaborated on investigations on suitable higher dialkyl tin compounds and promising results have already been obtained, although work on the problem is still in an early stage of development. It was found that di-n-octyl tin maleinate and di-n-octyl tin laurate have stabilizing effects of the same order as the corresponding butyl compounds but, unlike the latter, are not at all toxic. The Utrecht institute has also been able to discover a simple method of preparing n-octyl tin compounds.

German Plastics Institute

The foundation stone of the German Plastics Institute, which is being erected on the grounds of the Technical Institute, Darmstadt, was laid on May 26, 1955, in the presence of a distinguished gathering from official and scientific circles. Dr. L. Kollek, the president of the Plastics Research Association, reviewed the rebuilding of the German plastics industry which in 1945 had practically ceased to operate, but by 1954 was able to produce about 340,000 tons of plastics. He told how the strenuous efforts of the General Association of the Plastics Processing Industry and the Association of the Plastics Producing Industry and Allied Branches had resulted in the founding of the German Society for Plastics Research, on July 28, 1953, with the aim of establishing a German Plastics Institute.

Plastics in South Africa

Local production of plastic goods in South Africa has been hampered somewhat by a preference for British imports; however, several companies are now manufacturing plastic toys at competitive prices. South African enterprise in the toy field has not been wanting, and a Johannesburg firm has marketed a tubular plastic construction toy comparable to our Tinkertoy.

Another company has developed a floor covering consisting of plastic bonded to foam rubber. Available in solid colors and in embossed designs, it is reportedly very durable. A third Johannesburg corporation manufactures Perspex novelties, jewelry, display stands, and engraved plastic signs. Perspex dishes are made by a firm in Natal.

Plastics in East Germany

Synthetic resin production in the Soviet Zone of Germany has been confined almost entirely to phenolics and melamines, according to West German trade sources. Ureas, silicones, and laminated glass fiber are said to be in the initial stages of development.

A research institute has been established in Leipzig which, among other activities, will study processing techniques and technological applications of plastics. The Institute of Organic Chemistry in Magdeburg, and the research and development office of the public-owned enterprise "Kunstharz-und Pressmasse-Fabrik Espenhain" have been dissolved.

A synthetic resin fair was held in East Berlin in the autumn of 1953 with 14 public-owned enterprises and five scientific research institutes participating. The 1954 Leipzig Fair permitted exhibits by West German producers who reported very favorably on the East's progress. Some glass fiber plates for the walls of ships' superstructures were shown at a 1954 exhibition in Wismar, under the sponsorship of the Soviet Trade Mission.

Torolithe Casting Resins

Torolithe 511 and Torolithe L are two forms of a new, non-reinforced polyester casting resin produced in France by the S. A. Routtand, of Auberbilliers. Torolithe 511 is a semiviscous fluid with special properties; it is pigmented in bulk and available in various colors. Since molding takes place without pressure, any kind of mold material may be used provided the surface is perfectly smooth, otherwise the resin conforms to all the grainings and unevenness of the mold surface. Best results are obtained with glass and chromed or polished steel molds, but polished polyester resin molds are also satisfactory.

The molding process to convert the resin from liquid to solid via an intermediate gel state takes place either at 70-120° C. with a catalyst, or at room temperature with a catalyst and accelerator. In heat, the operation takes from a few minutes to an hour, depending on the temperature, thickness of the object, and the concentration of the catalyst. At atmospheric pressure and a temperature of 20° C., the time required is about 15 minutes for some castings.

Torolithe 511 has a softening point of 200° C., and has numerous uses in various fields, such as for furniture tops, kitchen and bathroom paneling, molds tables in dairies, floors in piggeries, toys, knife handles, etc. Torolithe L., which has a high dielectric strength, and excellent resistance to moisture and corrosion, is inteneded for electrical purposes, such as cold filling of junction boxes for cables, condenser cores, coatings for condensers, coils, etc.

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NAMES in the NEWS

Charles I. Marks

Charles I. Marks has been appointed general manager of Premium Plastics Co., Inc., Chicago, Ill., manufacturers of plastic food containers. He formerly served as vice president of Eisendrath Glove Co., and as president of Glove Stores, Inc. **Marvin O. Ritland** has been made sales manager.

Charles E. Guest and **Horace M. Pitcher** have been appointed sales representatives for American Viscose Corp.'s Avisco cellophane, covering the South Philadelphia and Louisiana and Mississippi territories, respectively.

Milton Rex Wingard has been appointed project engineer for the fats and oils department, chemical plants division, Blaw-Knox Co., Pittsburgh, Pa. He has been assigned to the division's Midwest headquarters in Chicago, Ill.

Robert W. Adam has been promoted to manufacturing manager of the tape division, Minnesota Mining & Mfg. Co., St. Paul, Minn.

J. C. E. Fuller has been named to direct new product market development at Naugatuck Chemicals Division, Dominion Rubber Co., Ltd., Elmira, Ont. Prior to his appointment, he was a member of the firm's technical sales staff.

National Petro-Chemicals Corp., has announced the following promotions at the Tuscola, Illinois plant:

John W. Nixon, from chief engineer to plant manager.

Charles D. Carnes, from assistant to chief engineer.

George A. Siegelman, from plant superintendent to assistant plant manager.

Clifford E. Oman, from area superintendent to assistant plant superintendent.

Robert E. Jones, Jr., from area superintendent of ethyl chloride to alcohol and ethyl chloride processes superintendent.

Gerald S. Tompkins has been elected president of American Viscose Corp., Philadelphia, Pa. He has been serving as vice president in charge of production. **Harry L. Dalton,** former vice president in charge of sales, becomes vice chairman of the board. **William H. Brown,** secretary and treasurer of the corporation, was elected a vice president. **Albert H. Hammond,** formerly assistant secretary, was named secretary. **George L. Storm** was elected a vice president and appointed general manager of the viscose division. **Paul E. Hill** was named general manager of the acetate division, and **Harold J. Michel** becomes general manager of the film division.

Edmund Claxton, director of research for Armstrong Cork Co., has been named president of the Building Research Institute, Washington, D. C. **William Muirhead,** president of William Muirhead Construction Co., Durham, N. C., is the new vice president. The terms of office are from July 1, 1955 to June 30, 1956. The six new members appointed to the Institute's Board of Governors are as follows: **Charles W. Attwood,** Unistrut Corp.; **John F. Hennessey,** Syska & Hennessey, Inc.; **Robert K. Mueller,** Monsanto Chemical Co.; **Otto L. Nelson,** New York Life Insurance Co.; **Andrew Place,** Place & Co.: and **Charles H. Topping,** E. I. du Pont de Nemours & Co., Inc.

Paul G. Logue

Paul G. Logue has joined Wica Chemicals, Inc., Charlotte, N. C., as manager of the new resin sales service department. He has been active in the development of resins and finishes for use in the textile industry.

R. W. Eddy and **J. J. Morris** have been appointed assistant general managers of the fine chemicals division of Carbide & Carbon Chemicals Co., New York, N. Y. **Mr. Eddy** had been product manager directing market development of chemical intermediates, and **Mr. Morris** performed the same function with respect to Flexol plasticizers and stabilizers.

Bruce F. Smith

Bruce F. Smith, manager of technical service in the international department of Dow Corning Corp., Midland, Mich., has been appointed Montreal, Quebec, branch office manager of the company's Canadian affiliate, Dow Corning Silicones, Ltd., Toronto.

C. E. Campbell has been named technical representative to the Washington, D. C., area for Velsicol Chemical Corp., Chicago, Ill.

John A. Price, John C. Mullarkey, and **Charles L. Balsingame** have been appointed technical service representatives by Oakite Products, Inc., New York, N. Y., to serve in the West Chicago, Phoenix, and Dayton areas, respectively.

Noel V. Wood, Jr., has been advanced to process engineering supervisor for Mobay Chemical Co., St. Louis, Mo.

William E. Kelly has been appointed St. Louis district manager for the chemical division of The Goodyear Tire & Rubber Co., Akron, O., replacing **J. E. Warner,** recently named assistant manager in the division's coatings department.

Herbert J. Reid has been appointed assistant general manager of the mechanical goods division, United States Rubber Co., New York, N. Y. **Homer O. McCracken** succeeds him as factory manager of the division's plant in Fort Wayne, Ind.

John J. Miller has been appointed Midwestern representative for Surface Chemicals, Inc., McKees Rocks, Pa. He will work with industry in the development and application of specialized coatings for fire-retardant mastics, epoxy films, and polyurethane foams.

Samuel D. Morgan has been appointed sales manager for Goodrich-Gulf Chemicals, Inc., Cleveland, O. Expansion is planned in various phases of petrochemicals, besides butadiene.

L. A. Doan has been appointed assistant general manager of the western division, Dow Chemical Co., San Francisco, Calif. He has served as western sales manager for the past four years.

Paul Stahlberg

Paul Stahlberg has been appointed technical service manager for the polyethylene resins department of Monsanto Chemical Co.'s plastics division, Springfield, Mass. He has been associated with the development phase of Monsanto's polyethylene program since its inception.

Joseph W. Holmes has been appointed sales manager for American Synthetic Rubber Corp., New York, N. Y., with offices at 500 Fifth Avenue.

Robert J. Minchak and **Delbert W. Rosenbaum** have joined the staff of The B. F. Goodrich Company Research Center, Brecksville, O., as chemical engineer and technical man, respectively. Also joining the Center's staff are Robert F. Singer and Charles R. McCulloch as junior technical man and chemist, respectively.

Jack F. Anschuetz has been appointed sales manager for Hamilton presses, with headquarters at Baldwin-Lima-Hamilton Corp.'s plant in Hamilton, O. He will be responsible for all press sales, service, field sales, and sales personnel. **E. H. Schoonmaker** was named eastern district sales manager, with offices in New York City. **W. A. Knight** becomes manager of the St. Louis, Mo., sales office.

William D. Claypool has been appointed executive director of Bassons Industries Corp., New York, N. Y. He was formerly president of Wm. D. Claypool Corp., and an industrial specialist for the War Department in Washington. **Harold B. Hill** was appointed executive assistant to the president.

John A. McNiff has been elected secretary of Mobay Chemical Co., St. Louis, Mo. He is a member of the New York Bar Association and the American Bar Association. **John L. Warner,** who has been serving as secretary-treasurer, will perform the latter function only.

Carl W. Sweitzer has been appointed director of research and development for the carbon black and pigment division of Columbian Carbon Co., New York, N. Y. **George L. Heller** continues as director of development, and **H. A. Braendle** becomes assistant to the vice president.

Adolph J. Kissileff has resigned as president of Amplex Mfg. Co., Philadelphia, Pa. His successor has not been named as yet.

Arthur P. Kroeger and **Cyrus W. Merrell** have been advanced to associate director of marketing and assistant to the director of marketing, respectively, in the organic chemicals division, Monsanto Chemical Co., St. Louis, Mo. **William M. Russell** and **Tullius C. Tupper** have been transferred to director of sales planning and director of sales operations, respectively, in the division, an exchange of functions.

George B. Baylis has been elected an assistant treasurer of Hercules Powder Co., Wilmington, Del., and **J. H. Tyler McConnell** has been elected secretary, succeeding **Mr. Baylis,** who had served in that position since 1948.

Conrad H. Busch

Kenneth G. Harms

Robert B. Zimmerli

Conrad H. Busch has been appointed advertising manager of The Polymer Corp., Reading, Pa. He joined Polymer after eight years of service in public relations and personnel work with the Narrow Fabric Co. **Robert B. Zimmerli** was named sales manager of the firm's subsidiary, National Polymer Products, Inc. Former product development manager, he served as development engineer with the polychemicals division of E. I. du Pont de Nemours & Co., Inc. **Kenneth G. Harms,** former sales manager, becomes technical service manager of the parent company.

Henry W. Rojas has joined Witco Chemical Co., New York 17, N. Y., as vice president of export marketing, and will be responsible for all present international operations of the company.

Mr. Rojas has 28 years of worldwide chemical experience, and was with American Cyanamid Co. for the past 21 years.

Fabian Bachrach

George J. Duffy

George J. Duffy has been appointed general manager of the minerals and chemicals division of Godfrey L. Cabot, Inc., Boston, Mass. He will direct production and sales of Wollastonite, Cab-O-Sil, and plastics and other chemicals. **J. Boyd Britton** has been elected operations vice president, and will coordinate research and development, personnel, technical service, production planning and control, and sales service. **William L. Loving** was elected vice president and manager of the carbon black division. **Raymond P. Rossman** has been appointed director of research and development. **Donald Simonds** has been advanced to Central regional sales manager, and **Daniel B. Doherty** has been promoted to Eastern division sales manager. **Ferd Nadherny** has been named assistant to **Mr. Simonds.**

Richard H. Hoffman has been named sales correspondent for the Chicago office of Du Pont's kinetic chemicals division, and **Douglas H. McKenna** has been assigned to the Milwaukee, Wis., territory as sales representative for Freon refrigerants and aerosol propellents.

Edward O. Hirschbeck and **Charles E. Wise, Jr.,** have been appointed plant operating engineers in the chemical engineering pilot plant of The Goodyear Tire & Rubber Co., Akron, O.

OBITUARY

William J. Hale

Dr. William J. Hale, prominent Dow scientist, died in Midland, Mich., on August 8, 1955, following a brief illness. Born January 5, 1876, in Ada, O., he received his bachelor's degree from Miami University, Oxford, O., and his masters and doctorate degrees from Harvard University.

Dr. Hale taught chemistry at the University of Michigan until joining Dow Chemical Co. in 1917. He established the Organic Research Laboratory in 1919, and served as its director until 1934 at which time he retired from active work to serve on a consultant basis.

Father of the science of chemurgy, Dr. Hale held 45 patents at Dow, was the author of numerous technical books, and held membership in many technical associations. He is survived by a daughter, Ruth Elizabeth. His wife, the former Helen Dow, died in 1918.

New Materials

Polymeric Vinyl Plasticizer

A polymeric plasticizer for vinyl resins, called Morflex P-50, has been introduced by Morton-Withers Chemical Co. A water-white liquid, it reportedly combines ease of handling and milling with compatibility and low extraction characteristics. The material is available in tank truck and carload lots.

Analysis data and properties of formulations are reported as follows:

Molecular weight	3,000
Hydroxyl number	35.40
Acidity, as acetic acid	0.210
Color	85-90
Viscosity @ 210° F., SSF	236.29
Sediment	None
Modulus at 200%, psi	2,325
Tensile strength, psi	2,800
Elongation, %	235
Shore hardness	90
Brittle point, °C	—15
Extraction in water,	
% in 10 days @ 25°	—0.5
In oil, %	0.0
In soap, %	—0.5
In air, %	0.0

Readers' Service Item M-1

GE Silicone Anti-Foam 60

A new silicone anti-foam emulsion for the prevention or suppression of foam in aqueous systems has been introduced by General Electric Co., silicone products department. Called Anti-foam 60, it is a low-viscosity emulsion that is said to eliminate costly handling problems usually incurred through the use of conventional viscous, paste-type silicone anti-foam agents. The material pours easily, is readily dispersable, even in cold water, and is non-flammable. Typical applications are in latex processing, adhesive manufacture, textile finishing, and fermentation processes.

Some physical properties include:

Silicone solids, %	30±1
Viscosity, centipoises, @ 77° F.	250-750
Weight per gallon, lbs.	8.3-8.5
Specific gravity, 20° C.	1.01-1.05

Readers' Service Item M-2

Magnet Wire Insulation

A heat resistant, polyester-type wire insulation has been marketed by General Electric's wire and cable department. Called Alkanex, the material is used to insulate magnet wire for electric motors, transformers, and other electrical equipment operating above 105° C.

Alkanex can reportedly withstand "hot spot" temperatures up to 150° C., allowing increased horsepower for motors without increase in size. It is estimated that 90-95% of all motors could operate in the Class B temperature range for which Alkanex is intended.

Among the specifications quoted by G-E for the material are snap resistance, ability of the film to resist cracking when jerked to the breaking point at a rate of 12-16 feet per second; an abrasion-scrape resistance of more than 30 strokes; and a resistance to cracking when heated in an air-circulating oven to 155° C. for five minutes. Wire diameters 0.0571-0.0720 inch should be able to withstand 2,300 volts A.C. when twisted together for a distance of five inches.

Readers' Service Item M-3

Secondary Vinyl Plasticizer

A low-viscosity chlorinated paraffin designed for use as a secondary plasticizer in PVC formulations has been introduced by Diamond Alkali Co. Known as Chlorowax LV, the material's 5-poise viscosity is considerably below the 20-40 range for standard 40-42% chlorinated paraffins.

Improved fluidity tends to give flexible plastics better physical characteristics at low temperatures, and better heat stability is useful when processing heat is encountered in blending operations. Typical properties are reported as follows:

Color, Gardner Scale	1
Viscosity at 25° C, poises	5
S.U.S., at 100° F.	902
At 210° F.	70
Specific gravity	1.13
Weight, lbs./gal.	9.4
Chlorine content, %	40
Solubility in water	None
Toxicity	None
Odor	None

Readers' Service Item M-4

Sponge Vinyl Plastisols

A new series of sponge vinyl plastisols has been put on the market by Watson-Standard Co., Pittsburgh, Pa. The plastisols contain chemical blowing agents and, when subjected to 300-400° F. heat for 3-30 minutes, will produce uniform vinyl sponge at expansions of 100-600% and with densities of 8-30 pounds per cubic foot. The sponge is said to be tough, flexible, non-shrinking, and resistant to oxidation, oils, greases, and most acids, alkalies and solvents. Available in many colors, the plastisols may be used for the manufacture of a variety of products, including rollers, cushions, upholstery backing, insulation, and shock absorbers, the company declares.

Readers' Service Item M-5

A Lubricant, Two Brighteners, and Two Advastab Stabilizers

Advance Solvents & Chemical Corp., has introduced an internal wax lubricant for vinyl formulations; two brighteners which impart a blue-white fluorescence to plastic formulations; and two stabilizers for vinyl resins. They are, respectively: Advawax 280; Advance Brightener M. D. A. C. and Advabrite M-10; and Advastabs XE-82 and 50-671.

Advawax 280 is a hard, high melting point synthetic wax resembling carnauba wax in appearance. Reportedly effective as an internal lubricant and anti-blocking agent for vinyl sheeting and rigid vinyl compounds, it remains in suspension throughout extrusion, calendering, or molding; then migrating to the surface to impart a glossy finish. Properties are listed as follows:

Melting range, °F.	280-290
Maximum acid value	10
Flash point, °F.	545
Fire point, °F.	580
Dielectric strength, volts/mil	430
Insulation resistance, megohms at 25° C.	68,000
Oxidation potential, millivolts	450
Power factor at 1,000 cycles	0.028

Advance Brightener M.D.A.C. is supplied as light tan granules having a melting point of 68-72° C., and a molecular weight of 231.28. The material is used in clear vinyl sheeting and films, polystyrene, cellulose acetate, polyamides, and other resins to lighten and remove yellowish casts. Concentrations of 0.001-0.1%, based on total weight of resin and plasticizer, are used.

Advabrite M-10 produces similar effects to M.D.A.C., but requires higher concentrations (0.01-1%). Reported properties include:

Color (G.H.)	6-7
Viscosity @ 25°C., A scale	3-4
Specific gravity	0.96-0.97
Refractive index	1.54-1.55

Advastab XE-82 is a purely organic compound that is a heat and light stabilizer for vinyl resins. It acts as a scavenger for HCl, and is synergistic with metallic stabilizers. Following are its reported properties:

Specific gravity @ 20° C.	1.06-1.07
Viscosity, Gardner V.	850-900
Color (Gardner-Holdt)	2.0
Pounds/gal.	8.9-9.0
Dosage, %	1-3

Advastab 50-671 is a polymeric thio-organo-tin stabilizer, said to have an odor level unusually low for sulfur-containing compounds. Compatible with all vinyl chlorides and most vinyl copolymers, it stabilizes effectively where heat-sensitive pigments are used to give light colored shades to films. It is also compatible with phosphate-type plasticizers. The following physical properties are reported:

Specific gravity @ 25° C.	1.03-1.04
Weight, lbs./gal.	8.65
Viscosity, A scale	1-3
Refractive index @ 25° C.	1.48-1.49
Color (Gardner-Holdt)	3-6

Readers' Service Item M-6

Vinyl Plasticizer

A low cost plasticizer, intended to replace the epoxidized soya-type plasticizers used in vinyl floor covering, welting, cable, garden hose, and other formulations not requiring a water-white end color, has been introduced by Brown-Allen Chemicals, Inc. Called Polycon #40, the material reportedly may be used in large amounts without affecting flexibility and hardness. Typical properties are listed as follows:

Specific gravity @ 20/20° C.	1.050
Acid Number	0.05
Color (Gardner)	11
Viscosity @ 25° C. cstks	2.50
Weight, lbs./gal.	8.9
Ester content, %	99.5
Odor	Bland

The following formulations and test data compare Polycon #40's physical properties with those of DIOP:

	parts	
Geon 101	100	100
Polycon #40	40	—
Polycon #11 (DIOP)	20	50
Barium-cadmium laurate	3	3
Tensile strength, psi. (ASTM D412-51T)	2,650	2,520
Elongation (ASTM D412-51T), %	370	365
100% modulus (ASTM D412-51T)	1,340	1,420
Durometer (Instantaneous)	84	85
Detergent extraction, 1% Tide 24 hrs. @ 70° C., %	0.6	0.1
Oil extraction, SAE 10, 72 hrs. @ 70° C., %	2.4	2.4
Tg °C. (ASTM D1043-51T)	−19	−19

Readers' Service Item M-7

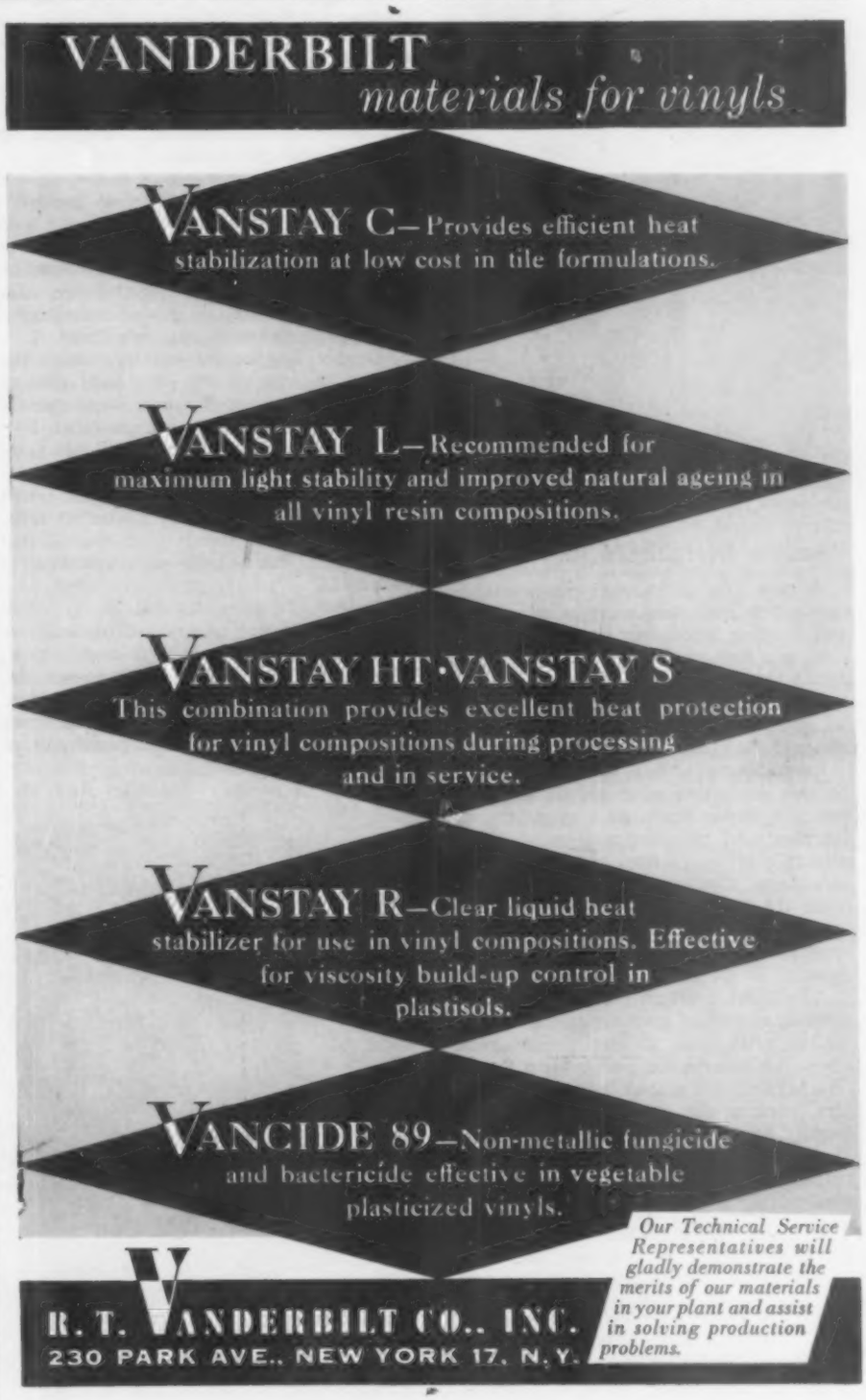
Low-Loss Laminating Resin

A laminating resin reported to outstanding electrical properties has been introduced by Emerson & Cuming, Inc. Designated Ecco L 65, the material is readily used with either glass cloth or mat to produce low-loss, low dielectric constant laminates for use in radomes, antennas, and printed circuits.

The material can be applied with a brush, and resulting laminates are said to retain excellent properties at temperatures up to 300° F. Properties of a typical laminate made with Ecco L 65 are reported as follows:

Dielectric constant	2.8
Dissipation factor	0.0008
Surface resistivity, ohms	10^{14}
Flexural strength, psi	12,000
Water absorption, %	0.04

Readers' Service Item M-8


VANDERBILT
materials for vinyls
VANSTAY C—Provides efficient heat stabilization at low cost in tile formulations.
VANSTAY L—Recommended for maximum light stability and improved natural ageing in all vinyl resin compositions.
VANSTAY HT·VANSTAY S
This combination provides excellent heat protection for vinyl compositions during processing and in service.
VANSTAY R—Clear liquid heat stabilizer for use in vinyl compositions. Effective for viscosity build-up control in plastisols.
VANCIDE 89—Non-metallic fungicide and bactericide effective in vegetable plasticized vinyls.
Our Technical Service Representatives will gladly demonstrate the merits of our materials in your plant and assist in solving production problems.
R. T. VANDERBILT CO., INC.
230 PARK AVE., NEW YORK 17, N.Y.

New Equipment

Stokes single-chamber continuous roll metallizer

Vacuum Metallizers for Rolls

A new line of vacuum equipment for continuous roll metallizing of plastic film and sheeting, condensor paper, textile fabrics, and thin sheet steel has been introduced by F. J. Stokes Machine Co., Inc. Designated Models 440, the suffixes 6, 24, 36, 48, 54, and 60 indicate the width of material they can accommodate.

Representing a new approach to continuous deposition of metal on a moving web, the Stokes units use a single vacuum chamber and pumping system which results in a saving of floor space and capital investment. Coatings ranging in thickness from 0.5-2 mils can be deposited continuously on rolls up to 24 inches in diameter, and at speeds of 500 feet per minute.

A brilliant, uniform metal coating is reportedly deposited over the entire width of the material with no dark or "burned" areas. An observation port, plus a fluorescent light source placed behind the coated film, permits the operator to check uniformity and quality of the coating. He can also adjust the speed of travel through the evaporation chamber for the desired thickness of metal deposit. Push-button controlled, air-poppet valves simplify unit operation.

Readers' Service Item E-1

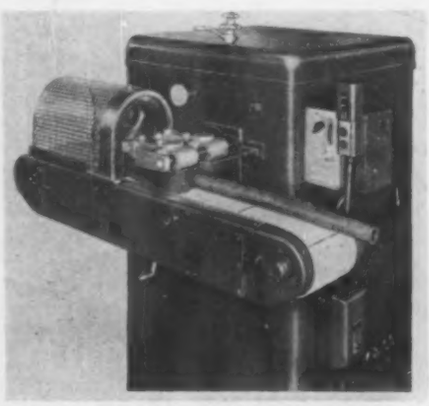
Multiple Extrusions Cutter

An automatic extrusions cutter, which can handle material up to three inches in diameter without collapse or distortion, has been introduced by F. J. Fink & Co. Designated M420A Wink Universal Cutter, the machine cuts hot or cold plastic, rubber, hose, and impregnated fabrics, continuously or intermittently, at speeds up to 3,000 cuts per minute.

With no recurrent loss of end stock, the waste is reportedly reduced as much as 90%. M420A has an all-geared head, and a cutting length range of 1/16 inch to over 100 feet. Remote control permits automatic regulation of speed to synchronize with the extrusion rate. Length of cut is regulated, independent of machine speed.

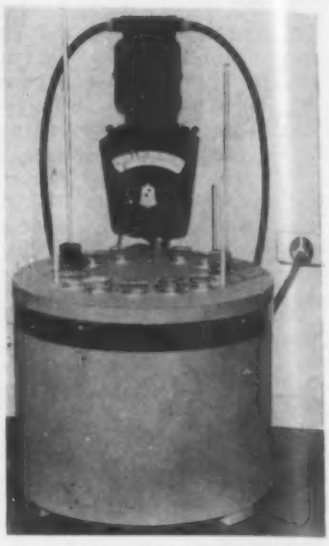
Longer lengths are cut by setting the knives at intermittent cut, and utilizing the solenoid-operated clutch. Knob control and micromatic settings are provided. Production rate varies greatly with the material being cut; however, a typical example finds O-ring molding slugs, ¾-inch OD by 3/32-inch wall by 32 inches long, are being cut at speeds in excess of 600 pieces per minute without the use of a mandrel.

On hot, freshly extruded stock, Wink is said to produce an unequalled finish. A distinctive pattern is left on cured stock, which is usually commercially acceptable, though sample cuttings should be obtained. Initial input drive is by twin V-belt from a variable speed transmission, positive drive to obviate slippage.



M420A Wink Universal Cutter

Readers' Service Item E-2

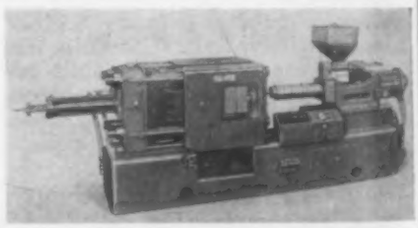


Comet Model 600 Aging Block

Laboratory Aging Block

An aging block for use in rubber and plastics laboratories that automatically controls precise temperatures from 100 to 600° F. has been introduced by Product Packaging Engineering. Designated Comet Model 600, the 15- by 18-inch, 175-pound unit contains 13 test tube compartments for test-tube aging, according to ASTM Method D865-52T, and aging in fluids such as oils and fuels. The block is made of machined aluminum, with a removable bottom plate for maintenance, and has baked enamel and chrome-plated external parts. The unit operates at 220-volts, AC.

Readers' Service Item E-3



Reed-Prentice 300TA-12/16 injection molder

Injection Molding Machine

A dry cycle time of ten seconds reportedly assures a high production rate with the new 300TA-12/16-ounce plastic injection molding machine introduced by Reed-Prentice Corp. Double shear toggle develops 300 tons positive mold locking pressure which makes it possible to mold large-area parts without flash.

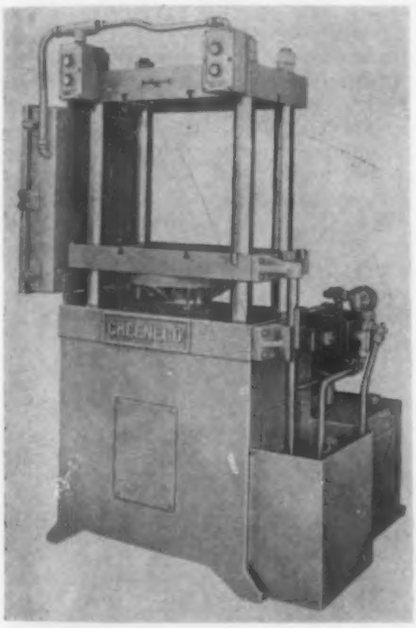
A new adjusting mechanism in the link cylinder makes mold clamping stroke variable between 7½ and 12½ inches. Four tie bars of 4-inch diameter form a sturdy frame for the link mechanism and the 29 by 32½-inch platens. Also new, the Reed-Speed heating cylinder plasticizes 115 pounds of material per hour. Three proportioning-type pyrometers provide accurate 3-zone temperature control. Ceramic heating elements give full surface contact.

A central operator's control station governs movement of die plate and plunger, mold adjustment, and heating cylinder set. A built-in stuffing arrangement increases injection capacity per shot to 16 ounces through multiple strokes. Other specifications are reported as follows:

Material hopper capacity, lbs.	150
Injection pressure, psi	20,000
Injection pressure, total lbs	141,760
Plunger diameter, in	3
Cylinder diameter, in	9.5
Plunger stroke, in	13
Plunger speed, in./min	130
Mold opening pressure, tons	9.5
Maximum mold thickness, ft	18
Minimum, in	8
Projected casting area, sq. in.	150
Motor, hp	30
Heater, Kw	21.7
Oil reservoir capacity, gals	150

Over-all dimensions for the 19,700-pound machine are: length, 13½ feet; width, five feet; and height, 7 1/12 feet.

Readers' Service Item E-4



Greenerd Arbor UA-4-10 vertical press

Vertical Hydraulic Press

A self-contained, vertical hydraulic press, designed to meet J.I.C. standards, has been introduced by Greenerd Arbor Press Co. Designated UA-4-10, the press has a pressure range from 1½-10 tons, adjustable by a setting on the relief valve. Specifications are listed as follows:

Platen size, in.:	
Front to rear	14
Left to right	20
Distance between platens, in.:	
Open	18
Closed	2
Press speed, in./min.:	
Closing	157
Return	331

Platen travel on the return stroke can be regulated mechanically, and the platen itself is equipped with bronze bushings to reduce friction as it rides along the strain rods. Movement is controlled by a 110-volt, 60-cycle AC transformer, push-button operated.

The cast Meehanite cylinder is bored and honed to size, and is equipped with steel piston and cast iron piston rings. Top and bottom caps are sealed with O-rings. Pressure may be held on work without injury to the press or hydraulic equipment. The machine illustrated in the accompanying photograph is equipped with a totally-enclosed, fan-cooled, 3-hp motor, which operates at 1,200 rpm.

Readers' Service Item E-5

Temperature Control Unit

A triple temperature control unit designed to provide accurately controlled heat up to 240° F. in the manufacture of plastic sheeting, has been introduced by Sterling, Inc. Designated Model 6031 Sterlco Temperature Control Unit, it consists of three Model 6012-B units mounted on a single base, and using a single power supply, water connection, and drain.

A combination of two high-temperature and one low-temperature units are commonly used on roll take-off applications; therefore, one cooling temperature control valve has the standard 80-170° F. range, and two have special ranges of 165-255° F. All thermometers are set for 60-260° F. Two heating thermostats range from 100-250° F., and the third has a regular range of 60-210° F.

Each section is equipped with a pressure switch to prevent the pump or heater from starting without adequate water pressure. Sheet extruders are expected to welcome this unit as a means of stepping-up production through proper calendar roll temperature. Model 6031 is also suited for injection molding and vacuum forming operations where three separate stabilized temperatures are required. Overall height of the unit (including casters) is 49 inches; length, 56 inches; and width, 12 inches.

Model 6031 Temperature Control Unit

Readers' Service Item E-6

Cryovac Model CW-C packager

Vacuum Packaging Machine

A versatile, new Cryovac vacuum packaging machine, featuring Boltaron vinyl plastic housings and providing fast, simple operation, is available from Dewey & Almy Chemical Co. Designated model CW-C, the new machine is semi-automatic and may be operated from a standing or sitting position for packaging many different food products. The plastic housing material is available in modern colors and finishes, thus eliminating the need for painting the machine.

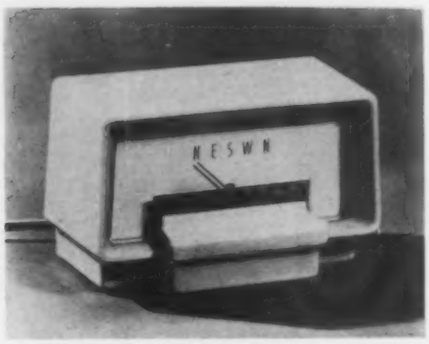
While basically similar to the company's model CW-B packager, the new unit incorporates several improvements: nozzle twisting mechanism and vacuum control redesigned for simpler operation; a cut-off knife with safety guard for automatically trimming the bag ends; an air-powered horizontal clip applier, furnished as standard equipment, which makes uniformly tight closures; and adaptable heads that permit use of the machine for a wide range of products. The operator may now slide, rather than lift, the product onto the vacuuming nozzle.

The bags used in the machine are made of the company's Cryovac, a special saran. In packaging, the product is slipped into the Cryovac bag whose neck is then placed over the machine's vacuum nozzle. The unit exhausts air from the bag, twists the bag neck, seals the bag, and trims away the excess. Packaging is completed by momentarily dipping the entire product in hot water to shrink the bag and make it cling to the contours of the product.

The model CW-C is shipped fully assembled, operates on a 115-volt A.C. current, and requires an air pressure of 50 psi. The machine is approximately 33 inches wide, 27 inches deep, and 59 inches high, and weighs about 440 pounds.

Readers' Service Item E-7

New Products



Antenna rotator cabinet of ivory colored urea

Urea Antenna Rotator Housing

An ivory-colored housing of Plaskon urea is being used to contain the control unit of Superotor, a TV antenna rotator manufactured by Leader Electronics, Inc. Saleability has reportedly increased due to its pleasing appearance, and the unit offers both high strength and excellent electrical properties.

Two control units are presently available; the Meter Model with illuminated dial which operates automatically, and the less expensive Twin-Light Model which gives tuning control to all Superotor installations. They measure 6¼ by 3½ by 3¾ inches, and have a fingertip tuning bar. Plaskon urea is supplied by Barrett Division, Allied Chemical & Dye Corp.

Readers' Service Item P-1

Acrylic Speedometer-Deflector

A combination air speed indicator and bug deflector molded in Rohm & Haas' Plexiglas acrylic plastic has been introduced by Sinko Mfg. & Tool Co. Called the Speed-Ector, it features a transparent dial which silhouettes the speed figures in the on-coming headlights.

Transparent wings on each side of the indicator dial serve as bug deflectors and give the instrument the graceful lines of a hood ornament. The speedometer is air-operated and has no mechanical parts. Air streaming over the hood enters a small tube projecting in front of the nose plate and blows against a small fan on the tip of the spring-mounted speedometer needle.

The instrument is priced to compete with standard bug deflectors, and is the first to be molded in one piece from acrylic plastic. Use of this weather-resistant material has reportedly reduced the troublesome clouding, yellowing, and cracking of earlier bug deflectors.

Combination speedometer-bug deflector mounted on auto hood

Readers' Service Item P-2

Lunn's reinforced plastic cable clamps

Reinforced Plastic Clamps

Non-corrosive, fire-resistant reinforced plastic cable clamps are being marketed on a nationwide basis by Lunn Laminates, Inc. Reportedly ideal for applications where vibration and shock are important factors, the clamps should find use in the petroleum, chemical, electrical, marine, and automotive fields.

Advantages of reinforced plastic clamps are reported as follows: will not promote electrical contact as will metal clamps; possess inherent resistance to abrasion; require no non-conductive lining; and withstand high temperatures. The clamps are available in size numbers from 2-32, and in ⅛-2 inch cable diameters.

Readers' Service Item P-3

Liquid soap forms bubbles due to Koroseal's locked-in air

Air-Porous Vinyl Upholstery

An upholstery material consisting of microscopic, inter-connecting cells of B. F. Goodrich Co.'s vinyl resin has been introduced on the market. Called Air-Porous Koroseal, the material is said to have over 50,000 cells per square inch which act as insulation against heat transfer, thus affording greater comfort both in summer and in winter.

Air-Porous Koroseal is washable and water-repellent. It can be applied to any type of fabric backing and readily conforms to furniture contour. A variety of patterns in simulated leather and fabric impressions are available for home and office use.

Readers' Service Item P-4

Melmac forms attractive place setting

Tri-Color Melamine Dinnerware

The first "patterned" melamine dinnerware has been introduced on the market by International Molded Plastics, Inc. Called Brookpark, the line presently consists of a pair of three-color patterns called Fantasy and Champagne.

Heat-fixed decorations are sealed beneath the surface and, being molded from chip- and break-resistant Melmac, assure permanence of design. Translucent as china, the dishes are reportedly difficult to distinguish from vitreous ceramic. A 16-piece starter set is currently available.

Readers' Service Item P-5

Counter-top polystyrene match-dispenser.

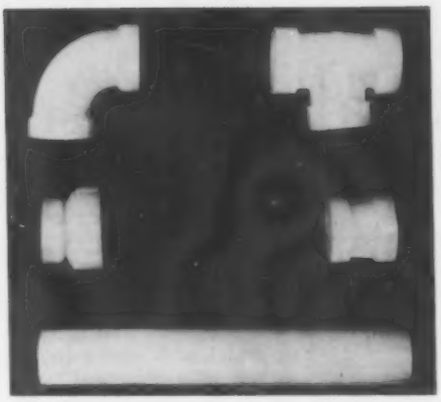
Polystyrene Match Dispenser

Book matches, frequently classified as a loss item by retailers, can be turned into profitable merchandise with Dispensa-Match, a vending machine introduced by Plastic Vending Machines, Inc. At the rate of two match books for a penny, the machine is said to pay for itself after dispensing two cases of matches.

Molded from polystryrene by the Bolta Products division of General Tire & Rubber Co., it provides a colorful, eye-catching appearance in bright shades of red and yellow. Rubber suction cups protect counter tops and hold the machine securely. A coin box holds up to 200 pennies.

Dispensa-Match is designed to vend any standard size book matches, and has a capacity up to three boxes. Dimensions are 14 inches high, 11 inches long, and five inches wide.

Readers' Service Item P-6



LaPine polyethylene pipe and fittings

Polyethylene Pipe Fittings

Two complete lines of polyethylene fittings, threaded and sleeve-type, have been introduced by Arthur S. LaPine & Co. Each line includes elbow bends, short tees, swept tees, and swept bends, and the threaded line also includes a half coupler with a male thread and a half coupler with a loose nut.

One- and six-foot lengths of 1¾-inch O. D. pipe are available. All fittings and pipe are 1½ inches I. D., and are natural white in color. A stainless steel band clamp is marketed for connecting sleeve fittings, and a blanked screw cap for cleaning.

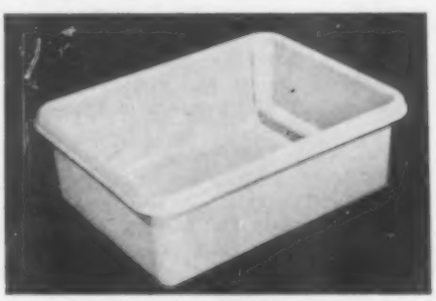
Readers' Service Item P-7

Reinforced Plastic Tray

A fibrous glass-reinforced polyester tray has been developed by the Molded Fiberglass Tray Co., for use on production conveyor belts. Measuring 17 by 23 by eight inches, the tray can also be used as a nesting box for parts storage.

Designated Number 467, the tray has additional reinforcements at the end where it comes in contact with other trays on the conveyor. Other advantages include constant tare weight, high strength-weight ratio, and ability to hold its shape.

Readers' Service Item P-8



Glass-reinforced polyester conveyor tray

Vinyl Photographic Film Print

Continuous-tone photographic images can be developed by heat all the way through a new flexible film known as Calimar. A product of Ferro Chemical Corp., it offers a wear-resistant reproduction for use as a display, decoration, or photo-recording.

Bakelite vinyl resins are dispersed in plasticizer, diluent, and filler to form an organosol paste in which picture-forming chemicals are mixed. The mixture is ball-milled for 20 hours and drawn down on a supporting backing to form a photo-sensitive film which, when dried and cured, is three mils thick and self-supporting.

Following contact to a photographic negative and exposure to ultra-violet light for about one minute, the film is developed in a hot air oven or infra-red heater for about six minutes at 320° F. The film is easily peeled off the backing, and presents a permanent image in warm brown tones (methods of obtaining true blue-blacks are under investigation). The film itself may vary from transparent to opaque, and may vary in flexibility from completely pliable to very rigid.

Developed film being stripped from backing

Conceivable applications include license plates, durable maps and blue prints, wear-resistant patterned floor tile, and forge-proof identification passes. Calimar may be exposed through endless negatives or stencils to produce decorative patterns, design for textiles, drapery fabrics, vinyl handbags, and the like.

The film is presently available for experimental purposes in Pilot Plant quantities.

Readers' Service Item P-9

New Literature

"The Use of Plaskon Alkyd Molding Compounds." Barrett Division, Allied Chemical & Dye Corp. 8 pages. Putty, granular, and reinforced alkyds are discussed with specific recommendations as to the proper tools, equipment, and techniques for processing each type. Presses, mold design and construction, preheating, preforming, and molding with inserts are described. Graphs illustrating minimum cure time and temperatures are included.

Readers' Service Item L-1

"Marlex 50 Ethylene Polymer." Phillips Chemical Co. 6 pages. This brochure lists typical physical, electrical, film, and permeability properties, as well as applications for Marlex 50, a low-pressure polyethylene.

Readers' Service Item L-2

Publications of Barrett Division, Allied Chemical & Dye Corp.:

"Plaskon Coating Resins." 6 pages. This booklet lists solution and solids properties of the following coating resins: alkyds, ureas, melamines, silicon-alkyds, modified phenolics, maleics, and ester gums.

Readers' Service Item L-3

"Plaskon Nylon Molding Compound." 6 pages. Physical properties and molding characteristics of Plaskon Nylon 8200 are presented in this booklet, along with tabular data and charts. Characteristics such as low molten viscosity, controllable crystalline structure, and sharp melting point are stressed.

Readers' Service Item L-4

"Plaskon Alkyd Molding Compounds." 4 pages. This folder gives product data on granular, putty, and glass-reinforced alkyds, and describes their insulating performance. Six of the materials are mineral-filled, and three are reinforced with fibrous or chopped mat.

Readers' Service Item L-5

"Acrylo-News." American Cyanamid Co., 7 pages. A continuing bibliography of acrylonitrile references, it includes a brief abstract of each article.

Readers' Service Item L-6

"'dag' Dispersions for Industry." Acheson Colloids Co. 4 pages. The booklet lists and gives the properties and applications for 44 colloidal and semi-colloidal dispersions, including operational and mold-release lubricants, manufactured by Acheson. Graphite, molybdenum disulfide, mica, vermiculite, zinc oxide, and acetylene black are included, and carriers and diluents are given for each item.

Readers' Service Item L-7

"Isophorone." Carbide & Carbon Chemicals Co. 8 pages. Physical properties, specifications, shipping data, general solvent properties, constant-boiling mixtures, physiological properties, and uses for Isophorone are contained in this bulletin. The compound is a solvent for most synthetic resins, and is incorporated in most vinyl metal finishes applied by roll-coating techniques.

Readers' Service Item L-8

"Adipic Acid." Technical Bulletin O-105. Monsanto Chemical Co. 30 pages. Physical and chemical properties, specifications, and shipping information on adipic acid, a raw material used in the manufacture of polyesters and plasticizers, are given in the first six pages of this bulletin. The other 24 pages discuss reactions and products, as described in patent and reference literature.

Readers' Service Item L-9

"Fire Hazards of the Plastics Industry." National Board of Fire Underwriters. 70 pages. The compositions and production of industrial plastics are discussed, with attention focused on the flammability of their ingredients. A section is devoted to the storage, handling, and processing of flammable materials, and to the regulating of temperature and pressure in controlled reactions.

Two other chapters are devoted to thermal stability and a fire safety program for the plastics industry. The first covers thermal distortion and burning rate testing, as well as the toxic gases released by burning plastics; the latter, standards and codes for the fabricator.

Readers' Service Item L-10

"Methyl Isobutyl Ketone." Carbide & Carbon Chemicals Co. 4 pages. Properties, specifications, and applications are given for this solvent which is used in the formulation of nitrocellulose lacquers, and with coating resins. The latter include vinyl chloride-acetate copolymers, most acrylic esters, some alkyds, and polyvinyl acetate.

Readers' Service Item L-11

"The How Book for IMS Extra Capacity Heating Cylinders." Injection Molders Supply Co. 32 pages. This illustrated booklet explains how the heaters are made, how to measure and install them, and how they are operated and maintained. Sections are devoted to butyrate, vinyl, and Kel-F molding, and to the IMS welding technique.

Readers' Service Item L-12

Publications of Chemical & Power Products, Inc.

"Chempro Teflon Ring Packing for Acids and Strong Chemicals." Bulletin No. CP552. 4 pages. Styles and types, and installation instructions.

Readers' Service Item L-13

"Chempro Teflon-Jacketed Gaskets." Bulletin No. CP553. 4 pages. Cross-sections of styles, specifications, and installation instructions.

Readers' Service Item L-14

"Chempro Teflon Packing, Gaskets, Stock for the Process Industries." Bulletin No. CP554. 4 pages. Physical properties of molded Teflon, photographs of molded and machined parts, and offerings of Teflon stock.

Readers' Service Item L-15

"Marlex 50 Ethylene Polymer." Phillips Chemical Co., 5 pages. This folder lists the physical, electrical, film, and permeability properties of Marlex 50, the company's new ethylene polymer, and includes descriptions of suggested applications, such as film, bottles, housewares, pipe, laminates, fibers, and industrial moldings.

Readers' Service Item L-16

"The Prevention of Occupational Skin Diseases." Louis Schwartz. Association of American Soap and Glycerine Producers, Inc., New York, N. Y. 42 pages. The causes, cures, and prevention of occupational skin diseases, which constitute about two-thirds of all occupational diseases reported to state compensation boards, are discussed here by a former U. S. Public Health Service medical director.

Readers' Service Item L-17

Book Reviews

"Cellulose and Cellulose Derivatives—Part I." Edited by Emil Ott, Harold M. Spurlin, and Mildred W. Grafflin. Interscience Publishers, Inc., 250 Fifth Ave., New York, N. Y. Cloth, 6¼ by 9½ inches. 525 pages. Price $12.00.

Part I in a three-part, revised edition of Volume V, High Polymer Series, this work consists of a group of monographs by experts in the field, plus introductory and supplementary material by the editors. An initial chapter is devoted to the occurrence of cellulose, which covers its formation, identification, and sources. A considerably longer chapter explains its chemical nature; covering chemical structure, degradation, end groups, and base-exchange properties.

The final two chapters give the structures and properties of cellulose fibers, plus the properties of naturally-occurring associated substances. Microscopic and submicroscopic structures, sorption relationships, and arrangement of cellulose chains are explained in the former; properties of wood, lignin, and noncellulosic carbohydrates in the latter. The book should be of interest to all concerned with the chemical technology of cellulose and its derivatives.

"Cellulose and Cellulose Derivatives—Part II." 552 pages.

This work is divided into four chapters covering the preparation of cellulose from its natural sources, bleaching and purification of wood cellulose, properties and treatments of pulp, and cellulose derivatives. The last chapter should be of particular interest to those concerned with cellulose plastics. Reactivity is considered, and sections are devoted to organic esters, inorganic esters, alkali and metal derivatives, ethers, and xanthates. Numerous formulas and tables are included.

"Mechanical Properties of Rigid Plastics at Low Temperatures." PB 111579. OTS, U. S. Department of Commerce, Washington 25, D. C. Paper, 143 pages. Price, $3.75.

Prepared by the Picatinny Arsenal in May, 1954, this report provides valuable design data and information on the low-temperature properties of 56 different rigid plastics (all commercially available types). These include a wide variety of laminated, molded, and cast thermosetting materials as well as cellulose, polystyrene, and polymethyl methacrylate thermoplastics.

Tests were conducted at temperatures ranging from minus 65-plus 70° F., and included tensile modulus of elasticity, proportional limits, elongation at break, Izod impact strength, and ultimate tensile strength. Performance charts and analyses are included.

"Plastics Tooling." Malcolm W. Riley. Reinhold Publishing Corp., 430 Park Ave., New York, N. Y. Cloth, 4¾ by 7 inches, 125 pages. Price, $2.50.

A Pilot Series book, this illustrated work considers plastic tooling from a number of aspects: the resins used; fabricating techniques, method of making die models and prototypes, and experimental projects. The pros and cons of plastic tooling are discussed, as are the advances to date.

The four resins used in plastic tooling, epoxy, phenolic, polyester, and ethyl cellulose, are covered in detail. Separate sections are devoted to metal forming and plastics forming tools. A selected bibliography is included. Though technical in nature, the book is written in clear, concise English understandable to the non-expert.

"Handbook of Engineering Materials." Edited by Douglas F. Miner and John B. Seastone. John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Cloth, 5½ by 8½ inches, 1,093 pages. Price, $17.50.

Designed to serve the engineer as a single source of information on the various materials of construction, the volume includes a 55-page section devoted to plastics. This handbook has a professed scope somewhere between a technical dictionary and a specialized textbook.

Information is arranged by classes of related or similar materials to make a common meeting ground for specialized engineers. The book is classified into four major sections: general information on materials; metals; non-metals; and construction materials. Fifty-one contributors are credited for the various component parts. A number of easily-thumbed tables and graphs are included, and the work also abounds in selected references and bibliography.

"Plastics in Housing." Department of Architecture, Massachusetts Institute of Technology. Paper, 11 by 14 inches, 70 pages. Available from Monsanto Chemical Co., Springfield, Mass. Price, $2.00.

The report of a study sponsored by the plastics division of Monsanto Chemical Co., the book covers both present and potential uses of all the known plastic materials in the building field. Illustrated by drawings, it includes sections devoted to foundations and structures, walls and roofs, flooring, openings, ceilings, partitions, mechanical elements, storage and furnishings, and potentialities. Practically a must for architects and technical service personnel.

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Abstracts of Important Articles

MATERIALS

"Styrenation of Alkyds with Controlled Functionalities," Leon Shechter and John Wynstra, *Ind. Eng. Chem.*, 47, 8, 1602 (Aug. 1955).

The styrenation of alkyds containing a reactive double bond such as that of a maleic ester is discussed, with emphasis on the ease of gelation of catalyzed, low pressure laminating maleic polyester-styrene solutions. The alkyd specification is set up in terms of its "maleic functionality," defined as the average number of maleic ester groups contained in the average alkyd molecule. This reportedly permits a prediction as to whether a given combination of alkyd raw materials will yield a soluble or gelled product, and a homogeneous or heterogeneous mass.

"Making Monomers and Polymers with Sodium," Marshall Sittig, *Modern Plastics*, 32, 12, 150 (Aug. 1955).

Metallic sodium is finding usage in the plastics field in the manufacture of dibasic acid monomers, as a polymerization catalyst, and in the reduction of natural fats to long-chain alcohols which may be employed as plasticizers.

"University Research on Engineering Properties of Plastics," Frederick J. McGarry, *Ind. Eng. Chem.*, 47, 7, 1305 (July, 1955).

At MIT, students are trained in research as a result of industry-university effort; examples being static testing techniques, analytical methods, dynamic testing techniques, and engineering applications.

"Time- and Temperature-Dependent Modulus Concept for Plastics," C. H. Weber, E. N. Robertson, and W. F. Bartoe, *Ind. Eng. Chem.*, 47, 7, 1311 (July, 1955).

The curvature of the constant moment portion of a four-point loaded beam is used to calculate a modulus of elasticity at the temperature and time of observation. A log-log plot of this modulus versus time yields a straight line for values of time between 1-75 days.

"Mechanical Properties of Rigid Plastics at Low Temperatures," Henry A. Tisch, *Modern Plastics*, 32, 11, 119 (July, 1955).

Tensile and impact properties of 56 rigid plastic materials at temperatures of 77, 10, —40, and —65° F., are presented in terms of bar charts.

"Spherulites," G. Schuur, *Plastica*, 8, 5, 258; 8, 6, 333; and 8, 7, 366. (May, June & July, 1955).

High polymers can crystallize in two different ways. Quenching and heating results in many small crystallites oriented at random. During normal crystallization, however, an internal flow of material occurs, known as the auto-orientation mechanism, since the molecules orient themselves before crystallization. The part that this mechanism plays in the growth of normal spherulites and, to some extent, of special spherulites is demonstrated. The mechanism also helps to explain why a high polymer never crystallizes under equilibrium conditions, and the melting point increases with increasing temperature of crystallization. The crystallization material in quenched polymers may be discontinuous, but is continuous within the limits of the spherulites. Under these conditions, there are no crystallites separated by amorphous material in normally-crystallized high polymers. (In Dutch).

"Ethylene and Acetylene Production," J. F. Farnsworth, Milton Manes, G. V. McGurl, and G. M. Bretz, *Ind. Eng. Chem.*, 47, 8, 1517 (Aug. 1955).

The successful production of acetylene by regenerative thermal cracking of hydrocarbons over a mass of hot refractory using specially patented tile has been accomplished at the Koppes-Hasche pilot plant, Verona, Pa. Design problems, plant operation, and experimental data are given for the production of acetylene from natural gas; acetylene and ethylene from propane; ethylene from ethane; and ethylene from ethane-propane mixtures.

"Pinonic Acid," G. S. Fisher and J. S. Stinson, *Ind. Eng. Chem.*, 47, 8, 1569 (Aug. 1955).

This acid, the esters of which are said to impart excellent low temperature properties, is prepared by ozonolysis of alpha-pinene. Yields were determined by partition chromatography. Pinic and homopinic acids are prepared from pinonic acid by hypohalite oxidation and the Willgerodt reaction, respectively.

"Viscosity Stability of Plastisols," J. R. Darby and P. R. Graham, *Modern Plastics*, 32, 10, 148 (June, 1955).

Evidence is presented to show that diisodecyl adipate and diisodecyl phthalate impart low viscosity and extended shelf life to vinyl plastisols, and that the latter can be used with other plasticizers to impart special properties.

EQUIPMENT

"Wound Wire Stress-Measuring Strips for Measuring Pressure in Mechanical Presses for Plastics," J. Wolff, *Kunststoffe*, 45, 6, 226 (June 1955).

In the construction of special tools and machines for mass-producing molded goods, it is important to know the approximate mold pressure to be expected. Wound wire elongation measuring strips, as demonstrated in the case of the manufacture of lamp sockets, are particularly useful for this purpose. Consisting essentially of a fine twisted wire glued to a thin paper backing, they are pasted with special adhesive to a suitable part of the machine to be tested. The change in the electric resistance of the wires after appropriate standardization, is a direct measure of mold pressure. (In German.)

"Machines for Processing P.V.C.," G. Ughetto and C. Colombo, *Poliplasti*, 3, 9, 4, (May-June 1955).

Calenders of the L. vertical, and Z types are considered, and special reference is made to a Z-type Italian design. (In Italian).

"Mold Designs for Injection Molding Machines," H. Gastrow, *Kunststoffe*, 45, 6, 249 (June 1955).

Molds for parts with internal undercuts, threads, projections, and hollows are discussed. (In German).

"New Methods in the Construction of Low-Pressure Molds," H. Rauch, *Kunststoffe*, 45, 6, 252 (June 1955).

The manufacture of molds from artificial stone-molding composition for use in low pressure and vacuum molding is described in detail, particularly the designing of the frame, preparation for casting, the multi-layer casting process, and treatment of the surface of finished molds. The considerable economic advantage of the new method is shown in a bill of costs. (In German).

"Engineering Mold Design," Wayne I. Pribble, *Modern Plastics*, 32, 10, 121 (June, 1955).

Importance of good part drawings to the mold designer and good mold designer's drawings to the mold maker are stressed. Sample drawings for a molded cabinet are included, pointing out features of special interest.

"Temperature and Pressure Measurements in the Injection Machine Heating Cylinder," C. E. Beyer, R. B. Dahl, and R. B. McKee, *Modern Plastics*, 32, 10, 127 (June, 1955).

Pressure loss is reduced by careful nose design, using the highest possible temperatures in the chamber's "granular zone," adequate torpedo heat, by preheating or packing the granules.

PROCESSING

"The Use of Electroformed Molds in Decorating Plastics," F. Chatterton, *Canad. Plastics,* 28 (July 1955).

Polyethylene containers are meeting with sharp competition from attractively labeled and decorated glass. Methods, based on known processes, are described for decorating plastics to beat this competition.

"Molding Polyesters by the Pre-form Process," J. van Ruys, *Plastiques Informations,* 1 (July 16, 1955).

The equipment (including a machine of French design) and processing methods for making preforms of polyester resins are described. It is pointed out that until recently, results obtained with polyester resins made in France were not as good as those possible with American material. (In French).

"The Effects of Conductor Temperature on the Quality of Extruded Vinyl Wire Insulation," E. E. Griesser and M. M. Suba, *Rubber Age,* 77, 3, 391 (June, 1955).

Heat shock failures can be overcome by extruding the compound at optimum high temperatures of 300-350° F. This insures maximum tensile strength and elongation, and minimum shrinkage. Controlled conductor temperature also insures good adhesion of insulation to conductor for a given compound.

"Treating Polyethylene for Printing," Stanley F. Bloyer, *Modern Plastics,* 32, 11, 105 (July, 1955).

A brief evaluation of existing methods for preparing polyethylene surfaces for ink adhesion, the article covers stretching, chemical etching, heat differential, and electron bombardment.

APPLICATIONS

"Vinyl Resins in Varnishes," E. Cernia and F. Coniglio, *Materie Plastiche,* 21, 7, 556 (July 1955).

The authors explain some of the problems connected with the use of vinyl resins and copolymers of vinyl chloride and vinyl acetate in the manufacture of varnishes. Tables and graphs are given to show the variations of the viscosity of vinyl copolymers as functions of different proportions of diluent solvent and percentage of solids. Above a certain range of solids content and with definite proportions of diluent solvent and at the same temperature, the viscosity increases resulting first in thixotropic solutions, next in gels, and then in precipication of the resin. Materials based on polyvinyl butyral, polyvinyl acetate, polyvinyl alcohol and polyvinylidene chlorides also are briefly mentioned. (In Italian).

"Engineering Plastics into Chemical Plants," H. E. Atkinson, *Ind. Eng. Chem.,* 47, 7, 1299 (July, 1955).

Material selection, equipment design, material specification, fabrication, installation, and maintenance are reviewed in this article.

"Polyethylene and its Application in Electric Cable," G. Palandri and U. Telogatti, *Materie Plastiche,* 21, 7, 569 (July 1955).

After reviewing the physical, chemical and electrical properties of polyethylene, the author describes its early uses in electric cables and the difficulties encountered. Then, the uses of polyethylene for insulating submarine, telephone, and high tension cables, and as sheathing for cables are discussed. (In Italian).

"Food Processing Plants," Lawrence J. Turney, *Ind. Eng. Chem.,* 47, 7, 1366 (July, 1955).

Experimental applications of plastics have eliminated some contamination, corrosion, erosion, and friction; however, long-term studies on possible plastic deterioration are needed. The potential field appears tremendous in scope.

"Modified Styrenes for Structural Applications," Robert H. Steiner, *Ind. Eng. Chem.,* 47, 7, 1307 (July, 1955).

Physical properties of the commercially available types are given to indicate their versatility of application, stressing the economic advantages of low specific gravity and high heat distortion. Molded and extruded sheets are readily solvent-cemented and vacuum formed.

Request for copies, reprints, or further information on any article abstracted in this department should be addressed to the publisher of the magazine where the article appeared. The publishers and their addresses are given below:

"ASTM Bulletin"
American Society for Testing Materials
1916 Race St., Philadelphia 3, Pa.

"Australian Plastics"
Australian Trade Publications, Ltd.
171 Sussex St., Sydney, Australia

"British Plastics"
Iliffe & Sons, Ltd.
Dorset House, Stamford St.
London S.E.1, England

"Canadian Plastics"
341 Church St., Toronto, Ont., Canada

"Chemical and Engineering News"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Hule Mexicano y Plasticos"
Filomeno Mata 13-11, Mexico, D.F.

"Industrial and Engineering Chemistry"
1155 Sixteenth St. N.W.
Washington 6, D. C.

"Industries des Plastiques Modernes"
Les Publications Techniques Associees
40 Rue du Colisee, Paris 8e, France

"Kunststoffe"
Carl Hanser Verlag
Leonard Eck Str. 7, Munich 27, Germany

"Kunststoff-Rundschau"
Brunke Garrels, Verlagsbuchhandlung
Borgfelder Strasse 83, Hamburg 26, Germany

"Materie Plastiche"
Via Farneti 8, Milan, Italy

"Matiéres Plastiques"
Galerie du Center, Bloc 3
Rue des Fripiers, Brussels, Belgium

"Mechanical Engineering"
American Society of Mechanical Engineers
29 W. 39th St., New York 18, N. Y.

"Modern Plastics"
575 Madison Ave., New York 22, N. Y.

"Oesterreichische Plastic-Rundschau"
Ployer & Co.
Aegidiengasse 5, Vienna 6, Austria

"Plaste und Kautschuk"
Veb Verlag Technik
12 Unter den Linden
Berlin N.W.7, Germany

"Plastic"
Danish Technical Press
31 Vester Farimogsgade
Copenhagen 5, Denmark

"Plastica"
Kunststoffeninstituut T.N.O.
Julianalaan 134, Delft, The Netherlands

"Plastics"
Temple Press, Ltd.
Bowling Green Lane, London E.C.1, England

"Plastics World"
Cleworth Publishing Co., Inc.
22 W. Putnam Ave., Greenwich, Conn.

"Plastiques Informations"
94 Rue Saint-Lazare
Paris 9e, France

"Plastverarbeiter"
Verlagsgec. m.b.H.
Herxheim b. Landau/Pfalz, Germany

"Poliplasti"
E.T.A.S., Via Andrea Mantegna 6,
Milan, Italy

"Revista de Plasticos"
Inst. "Alonso Barba"
Serrano 119, Madrid, Spain

"Revue Générale des Matiéres Plastiques"
196 Ave. Jean-Jaures, Paris 19e, France

"Rubber and Plastics Age"
Rubber and Technical Press, Ltd.
Tenterden, Kent, England

"SPE Journal"
Security Bank Bldg., Athens, Ohio

Patent Digest

Materials

Methods of Bulk Polymerization. No. 2,715,117. Alfred Eugene Marius Baeyaert, Bron, France (to Societe Anonyme des Manufactures des Glaces et Produits Chimiques de Saint-Gobain Chauny & Cirey, Paris, France).

A liquid monomer is polymerized until the resulting mass has the appearance of a powder, but still contains a substantial percentage of monomer. Round objects such as marbles are added to the polymerization vessel to agitate and break up the already-formed polymer until the reaction is completed.

Process for Manufacturing Alkylated Methylol Melamines. No. 2,715,619. Tzeng-Jiueq Suen, Stamford, Conn. (to American Cyanamid Co., New York, N. Y.).

Water-soluble alkylated methylol melamine condensation products are prepared by reacting melamine and formaldehyde in a mixture of water and aliphatic alcohol. The reaction mixture is heated to a temperature between 50° C. and reflux, keeping the pH between 7 and 12.

Regeneration of Vinyl Acetate Catalyst. No. 2,715,140. William H. Vining, Niagara Falls, N. Y. (to E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.).

Acetylene and acetic acid vapor are reacted in the presence of a catalyst consisting of activated charcoal impregnated with zinc aceate. When the vinyl acetate has been produced, the catalyst is regenerated by treating with superheated steam and acetic acid.

Process for Preparing Vinyl Sulfonamides. No. 2, 715,142. Harold F. Park, East Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

Ammonium vinyl sulfonate is converted to vinyl sulfonamide by heating to 250-400° C. in the presence of non-vaporizing sulfur and substituted phenol.

Acrylonitrile Polymers Stabilized with Certain Glycol Ethers. No. 2,715,112. George W. Stanton and Forrest A. Ehlers, Walnut Creek, Calif. (to Dow Chemical Co., Midland, Mich.).

Acrylonitrile, which is 60% polymerized, and another monoethylenically-unsaturated compound are copolymerized in the presence of 1-20% by weight of a glycol ether stabilizing agent.

Catalyst System for the Emulsion Copolymerization of Butadiene and Styrene. No. 2,715,115. Joseph A. Blanchette, Springfield, and Roger G. Richards, Granby, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

In an aqueous emulsion system, 0.01-0.1 part dissolved sodium alkyl benzene sulfonate, 0.25-0.5 part of a catalyst, and 0.5-1.0 part of an alkyl mercaptan are heated with styrene and butadiene to the polymerization temperature. Sodium formaldehyde sulfoxylate is then added, and the reaction carried to completion.

Emulsion Polymerization of Styrene. No. 2,715,116. Henry Malcolm Hutchinson, Banstead, England (to Distillers Co., Ltd., Edinburgh, Scotland).

A styrene monomer is polymerized at a pH less than three in the presence of an aqueous emulsifying agent which is the salt of an alkanol monoester.

Phenolic Resinous Compositions. No. 2,714,098. Robert W. Martin, Lafayette, Calif. (to General Electric Co., Schenectady, N. Y.).

The composition comprises a phenol-aldehyde novolac resin, 6-20% by weight of hexamethylenetetramine, 5-20% by weight of a monomeric epoxide, and about 0.2-2 parts of a filler per part of said initial resin.

Polyaminopolyureas. No. 2,696,504 Robert S. Yost, Oreland, and Robert W. Auten, Jenkintown, Pa., assignors to Rohm & Haas, Co., Philadelphia, Pa.

A dihaloalkane and a high molecular weight polyethylenepolyamine, in almost equal proportions, by weight, are heated together at a temperature of 70-150° C. When a 60-65% aqueous solution of the condensation products reaches a Gardner-Holdt viscosity of G to Z_3 at 25° C., urea is added and the mixture again heated until a 50% aqueous solution of the resulting products has a Gardner-Holdt viscosity of about B to M at 25° C. The ratio of urea groups to NH groups should be between 0.2:1 and 1.5:1.

Printed copies of patents are available from the Commissioner of Patents, Washington 25, D. C. Price, 25c each.

—The Editor

Ternary Polymer Compositions. No. 2,713,562. Robert J. Reid, Canal Fulton, O. (to Firestone Tire & Rubber Co., Akron, O.).

A tough, homogenous composition is obtained by combining 60-80% of a styrene-acrylonitrile copolymer with 8-32% of a butadiene-acrylonitrile copolymer and 8-32% of hevea natural rubber.

Plastics Compositions Comprising a Vinyl Chloride Polymer and a High Softening Point-Coal Tar Pitch. No. 2,715,615. John M. De Bell, Longmeadow, and Mortimer H. Nickerson, Springfield, Mass. (to Orangeburg Mfg. Co., Inc., Orangeburg, N. Y.).

A thermoplastic resin, stable at temperatures to 140° F., comprises a vinyl chloride polymer and a lesser amount of coal tar pitch. The latter material should have a softening point of 160° F., and should be fluid at the molding temperature of the resin. The pitch comprises the sole plasticizing agent in the composition.

Equipment

Molding Press. No. 2,712,168. Frederick J. Kenline, Buffalo, N. Y. (to Lake Erie Engineering Corp., Buffalo, N. Y.).

The top and bottom mold plungers have dimensional stops for controlling the minimum spacing between the plungers, and the press itself has an operating cycle which includes a mold-filling phase, a pressing phase, and a press-opening phase. An electrical control system automatically adjusts the depth of mold fill, synchronizing with the dimensional stops. The control system also includes a reversible motor and a reversing line starter. A control relay permits energization of decrease winding during the press-opening phase of one operating cycle, and of increase winding when switch means are closed.

Die Locking Arrangement for Extrusion Presses. No. 2,715,459. Gerhard P. Krause, Harrison, N. Y. (to Loewy Construction Co., Inc., New York, N. Y.).

The die mechanism consists of a plurality of dies having different outer contour, and the locking means has a plurality of paired plates movable toward and away from the extrusion axis. These plates fill the space between the support member and the die mechanism, so that pairs of them can be moved rapidly to confine or free the die openings.

Pelletizer Apparatus. No. 2,715,438. Angus A. McDonald, Pontiac, Mich. (to Baldwin Rubber Co., Pontiac, Mich.).

This pelletizer for plastic materials comprises a means for intermittently advancing a sheet of material; means for controlling the length of material feed; a flat, elongate anvil with a plurality of spaced partition walls; a reciprocal cutting knife positioned to engage the anvil edge; and a plurality of knock-out fingers.

Bead Control Apparatus for Sheet Extruders. No. 2,712,155. Seddon C. Nelson, Fredericksburg, Va. (to American Viscose Corp., Wilmington, Del.).

The extrusion nozzle assembly comprises a relatively fixed nozzle blade and an adjustable nozzle blade secured in close-spaced relation to the fixed blade, thus forming an extrusion slot. The walls define a kerf adjacent to the terminus of the adjustable blade, one side of the kerf having a means for flexing the terminal end of the blade.

Method and Apparatus for Preparing Thin Films of High Melting Point Thermoplastics and the Application Thereof to Paper and the Like. No. 2,712,508. Peter J. Massey, River Forest, Ill.

Web material may be coated with such viscous materials as polyethylene which have high working temperatures by drying the web and bringing it into contact with a rotating heated roll; carrying the web on said roll to the nip formed between the rotating roll and a relatively stationary parallel roll; and feeding a sufficient amount of heated coating between the rolls which are set for a predetermined thickness. Contact time between web and coating is limited to prevent charring of the former.

Processing

Elastic Infusible Products from Epoxy Compounds and Cross-Linking Agents. No. 2,712,535. Willy Fisch, Binningen, Switzerland (to Ciba, Ltd., Basel, Switzerland).

A compound containing more than one epoxide group per mol is heated with a cross-linking agent containing at least two epoxide-reactive groups to form an infusible mass.

Process for Spinning Swollen Polyvinyl Chloride. No. 2,712,490. Rene Emile Fernand Stuchlik, Villeurbanne, France (to Societe Rhodiaceta, Paris, France).

PVC having a molecular weight of at least 15,000 is subjected to a non-solvent swelling fluid, and the resulting mass extruded through the orifices of a spinning plate at a temperature above the boiling point, and at a pressure higher than the vapor tension.

Process of Conducting Exothermic Bulk Polymerization. No. 2,714,101. James L. Amos, Joseph C. Frank, and Kenneth E. Stober, Midland, Mich. (to Dow Chemical Co., Midland, Mich.).

Styrene is mass-polymerized by introducing it into a zone having hollow indirect heat-transfer conduits. These are arranged so that all portions of the material are within two inches of the external surface of a conduit. Polymerization is then effected, and the material cooled.

Process for Improving the Properties of Polymerization Products from Styrene. No. 2,713,043. Guenther Daumiller, Ludwigshafen, Germany (to Badische Anilin & Soda Fabrik Aktiengesellschaft, Ludwigshafen, Germany).

A polymerizate of styrene having a softening point below 100° C. in a granulated state is suspended in an aqueous medium, with steam at a temperature of 110° C. being added. This is below the decomposition and agglomeration temperatures of the polymerizate; however, volatile constitutents are removed in the steam, leaving a composition which has an appreciably higher softening point.

Polymerization with Polymeric Adipoyl Peroxide Catalyst. No. 2,713,042. Harold F. Park, East Longmeadow, Mass. (to Monsanto Chemical Co., St. Louis, Mo.).

A mass polymerization process involving 100 parts styrene or vinyl halide and 0.01-5.0 parts of polymeric adipoyl peroxide being polymerized at a temperature of 100-400° C. and a pressure of 1-500 atmospheres.

Welding Plastic Film Sections. No. 2,713,017. Carl N. Burns, Branford, Conn. (to Connecticut Hard Rubber Co., New Haven, Conn.).

Plastic film sections are seamed by placing them in an overlapping relationship, inserting two electrical resistance wires in parallel spaced relationship between the overlapped portions, and applying current to fuse and integrate the sections.

Laminated Article and Method of Making Same. No. 2,713,016. Alexander C. Weiss, Tacoma Park, Md.

Woven fabric layers are impregnated with a thermosetting material in the plasticized state, punctured at a plurality of spaced points, and cured. Puncturing snags the threads, thereby bettering the bond.

Production of Polymer Spheres. No. 2,712,536. Field H. Winslow, Springdale, N. J. (to Bell Telephone Laboratories, Inc., New York, N. Y.).

A mixture of divinylbenzene and a monovinyl aromatic hydrocarbon is agitated with a polyvinylalcohol stabilizing agent in an aqueous medium. A suspension of fine spherical globules is formed, and polymerized to a rigid, non-tacky state.

Suspension Polymerization Using Synthetic Calcium Phosphate. No. 2,715,118. John Marshall Grim, Lancaster, Pa. (to Koppers Co., Inc., Pittsburgh, Pa.).

To prepare polymer beads in a stabilized aqueous suspension of polymerizable ethylenic monomer, synthetic calcium phosphate is added in the proportion of 1-15% by weight.

Plasticized Pellet of Thermoplastic Material and Process of Making Same. No. 2,714,076. Peter H. Seckel, New York, N. Y. (to Richard A. Fisch).

Thermoplastic pellets uniformly impregnated with plasticizer are made by dry mixing finely-divided thermoplastic material with a liquid plasticizer at a temperature below the plastic's melting point. The liquid is absorbed forming compact pellets which are heated to the melting point and cooled. This gives an even distribution of plasticizer throughout the pellet, and the outer surface of the pellet vitrifies to form a hard shell.

Stripping Vinylidene-Vinyl Chloride Copolymers with the Aid of Alkyl Acrylate and Product. No. 2,713,568. Thomas W. Fisher, Jr., Elverson, and George P. Rowland, Jr., Pottstown, Pa. (to Firestone Tire & Rubber Co., Akron, O.).

A copolymerization mass, consisting of 80-95% vinylidene chloride and the balance vinyl chloride and residual matter, is stripped by admixing alkyl acrylate at a temperature of 25-60° C. and subjecting the mass to other standard stripping conditions.

Printing on Polyethylene. No. 2,715,363. Keith S. Hoover, Elmhurst, Ill. (to A. B. Dick Co., Niles, Ill.).

Ink containing infra-red ray absorbing and heat-generating material is applied to polyethylene, which is non-infra-red absorbing. Infra-red heat is directed onto the web in high concentrations to soften the polyethylene and affix the ink in a predetermined pattern.

Methods of Jointing Surfaces by Heat-Hardening Resins. No. 2,715,598. John Rees and Harold John Pollard, Bristol, England. (to The Bristol Aeroplane Co., Ltd., Bristol, England).

Two, fully-cured thermosetting moldings with adhesively-jointed surfaces are joined to form an assemblage by introducing a layer of heat-hardenable adhesive and strip-like electrical conductors at all joints. Electrical current is then passed through to seal all of the sections simultaneously.

Applications

Bearing Compositions Containing Polytetrafluoroethylene. No. 2,715,617. Hobart S. White, Bethseda, Md. (to the United States of America as represented by the Secretary of the Army).

A bearing composition consists of a homogenous, compressed mixture of powdered tetrafluoroethylene resin and at least one metal of the group consisting of molybdenum, tungsten, and mixtures thereof. The resin forms 10-60% of the composition, by weight.

Domestic Production and Sales of Plastics and Resin Material, April and May, 1955

Following are the partly estimated and revised statistics for the domestic production and sale of plastics and resinous material during the months of March and April, 1955. Units listed are in pounds, dry basis unless otherwise specified. Data on alkyds and rosin modifications have not been included since their use is primarily limited to the protective coating industry.

Polyethylene has been removed from the miscellaneous category, and becomes a separate entry. Previously quoted figures have been corrected, with this entry, for April.

	April		May	
Cellulose Plastics:[1]	Production	Sales	Production	Sales
Cellulose acetate and mixed ester:				
Sheets, under 0.003 gage	1,398,906	1,452,743	1,253,143	1,359,224
Sheets, 0.003 gage and over	1,243,176	1,108,227	1,349,317	1,185,311
All other sheets, rods, and tubes	623,169	567,009	644,967	563,701
Molding and extrusion materials	7,574,476	7,406,053	7,758,301	7,464,172
Nitrocellulose sheets, rods, and tubes	427,180	433,764	402,714	396,181
Other cellulose plastics	584,278	478,399	560,509	609,946
TOTAL	11,851,185	11,446,195	11,968,951	11,578,535
Phenolic and Other Tar-Acid Resins:				
Molding materials[1]	18,876,464	16,372,342	17,707,929	16,097,186
Bonding and adhesive resins for—				
Laminating (except plywood)	5,159,155	3,820,505	5,974,164	4,439,375
Coated and bonded abrasives	1,204,860	1,262,860	1,428,918	1,387,774
Friction materials (brake linings, clutch facings, and similar materials)	2,188,320	1,958,151	2,111,997	2,097,977
Thermal insulation (fiber glass, rock wool)	3,624,480	3,667,114	4,170,813	4,059,745
Plywood	3,672,430	2,975,713	3,434,167	2,763,650
All other bonding and adhesive uses	1,352,704	1,320,364	2,138,443	2,129,372
Protectice-coating resins, unmodified and modified except by rosin	2,568,338	2,291,343	2,431,254	2,061,582
Resins for all other uses	3,370,039	3,270,370	2,899,993	2,540,412
TOTAL	42,016,790	36,938,762	42,297,678	37,577,073
Urea and Melamine Resins:				
Textile-treating and textile-coating resins	3,496,609	3,443,276	3,377,497	3,186,324
Paper-treating and paper-coating resins	1,958,882	2,038,283	1,744,910	1,697,081
Bonding and adhesive resins for—				
Plywood	7,741,433	7,583,765	8,399,031	7,560,602
All other bonding and adhesive uses, including laminating	3,058,263	2,579,109	1,908,848	1,970,105
Protective-coating resins, straight and modified	3,086,175	2,317,829	3,548,538	2,651,434
Resins for all other uses, including molding	7,455,711	6,767,495	7,205,446	6,801,341
TOTAL	26,797,073	24,729,757	26,184,270	23,866,887
Styrene Resins:				
Molding materials[1]	34,996,616	33,857,545	35,470,807	31,816,171
Protective-coating resins, straight and modified	8,304,109	8,469,020	9,059,629	7,720,016
Resins for all other uses	6,827,738	7,424,837	7,078,697	7,532,005
TOTAL	50,128,463	49,751,402	51,609,133	47,068,192
Vinyl and Vinyl Chloride Resins:[2]				
Polyvinyl chloride and copolymer resins (50% or more polyvinyl chloride) for—				
Film (resin content)		8,227,049		6,984,897
Sheeting (resin content)		4,709,243		4,429,090
Molding and extrusion (resin content)		15,568,118		14,452,489
Textile and paper treating and coating (resin content)[3]		5,779,100		5,240,024
Flooring (resin content)		5,134,130		5,108,558
Protective coatings (resin content)		2,601,266		2,448,552
All other uses (resin content)		3,271,231		3,546,613
All other vinyl resins for—				
Adhesives (resin content)		2,585,550		2,808,894
All other uses (resin content)		8,966,812		9,236,637
TOTAL	56,773,223	56,842,499	60,216,729	54,255,754
Coumarone-Indene and Petroleum Polymer Resins	22,533,226	23,011,097	22,503,247	21,007,363
Polyester Resins:				
For reinforced plastics	4,840,027	4,115,137	4,929,504	4,400,101
For all other uses	173,840	237,713	297,626	248,357
TOTAL	5,013,867	4,352,850	5,227,130	4,648,458
Polyethylene Resins	31,279,536	28,183,489	32,324,401	27,948,506
Miscellaneous Synthetic Plastics and Resin Materials:				
Molding materials[1] [4]	4,414,154	4,112,315	4,276,291	3,964,878
Protective-coating resins[5]	408,057	248,117	370,686	196,254
Resins for all other uses[6]	7,138,568	6,542,703	6,738,794	6,631,280
TOTAL	11,960,779	10,903,135	11,385,771	10,792,412
GRAND TOTALS	258,354,142	189,316,687	263,717,310	238,743,180

[1]Includes fillers, plasticizers, and extenders.
[2]Production statistics by uses are not representative, as end use may not be known at time of manufacture.
[3]Includes data for spreader and calendering-type resins.
[4]Includes data for acrylic, polyethylene, nylon, and other molding materials.
[5]Includes data for epichlorohydrin, acrylic, polyester, silicone, and other protective-coating resins.
[6]Includes data for acrylic, rosin modifications, nylon, silicone, and other plastics and resins for miscellaneous uses.

SOURCE: United States Tariff Commission, Chemical Division.

The Auto-Vac Co., has moved its sales and display operations to 1984 State Street Extension, Bridgeport, Conn., bringing of its operations under one roof.

Columbian Carbon Co., New York, N. Y., has taken over the sales and servicing of carbon blacks, iron oxides, and bone blacks which had been distributed by Binney & Smith Co. Also included are the various codispersions, aqueous dispersions, and chemical items. Edwin B. Brooks becomes general sales manager of Columbian's newly formed pigment division, and Randolph Foster will head pigment sales to the plastics, paint, paper, and ink industries.

Advance Solvents & Chemical Corp., New York, N. Y., held their second annual sales meeting of the PVC stabilizer division at the Hershey Hotel, Hershey, Pa., during April.

Gates Engineering Co., Wilmington, Del., producers of vinyl and neoprene coatings and liners, has appointed Ross Roy, Inc., New York, N. Y., as its advertising agency for its current national expansion program.

Union Carbide & Carbon Corp., New York, N. Y., was awarded the National Safety Council's Award of Honor for the second consecutive year on the basis of its 1954 safety record. The figures of 3.02 disabling injuries per million man-hours worked was 44% below par rate, and 0.58 days lost per thousand labor hours was 38% below the national average.

Ohio-Apex Division, Food Machinery & Chemical Corp., Nitro, W. Va., has announced a price reduction from 40-45¢ for tank car quantities of KP-90 epoxy plasticizer. The material is used as a primary plasticizer for vinyls, nitrocellulose, polystyrene, ethyl cellulose, and synthetic rubbers.

Marblette Corp., Long Island City, N. Y., has appointed Marble Plastic Co., Franklin Park, Ill., as sales-engineering representative in Illinois, Indiana, Iowa, Kentucky, Minnesota, and Wisconsin.

Luminous Resins, Inc., Chicago, Ill., has announced the availablility of daylight fluorescent molding powders in granular form, and having a polystyrene, polyethylene, polyvinyl, Tenite I & II, or acrylic base. These resins are reportedly ready for molding and require no special treatment.

Current Market Prices

Price Changes and Additions

Coating Resins			
G.M.I. Polyamide 100	*lb.*	$0.51 /	$0.64
115	*lb.*	.54 /	.77
Colors			
Advabrite M-10	*lb.*	2.25 /	2.40
Advance Brightener M.D.A.C.	*lb.*	12.00 /	15.00
Fillers			
Camel—CARB	*ton*	12.00	
—TEX	*ton*	20.00	
—WITE	*ton*	32.50 /	
Molding Compounds & Resins			
Acrylic			
Polycast 1	*sq. ft.*	.80 /	2.40
Polyamide			
G.M.I. Polyamide 115	*lb.*	.64 /	.77
Polyester			
Polycast 2	*sq. ft.*	1.89 /	5.18
3	*sq. ft.*	1.08 /	18.00
6	*sq. ft.*	.66 /	3.10
7	*sq. ft.*	.72 /	7.18
CR-39	*sq. ft.*	1.25 /	20.00
Polyethylene			
Poly-Eth 1003	*lb.*	.44 /	.58
1004, 1005, 1007, 1008.5	*lb.*	.41 /	.55
3015, 5015	*lb.*	.35 /	.49
Styrene			
Polycast 4	*sq. ft.*	2.56 /	11.07
Plasticizers			
Cabflex DDA, Di-OA, DOA, ODA	*lb.*	.425 /	.455
DDP, Di-OP, DOP, ODP	*lb.*	.305 /	.335
Di-BA	*lb.*	.4325/	.4625
Di-OZ	*lb.*	.48 /	.5075
HS-10	*lb.*	.44 /	.47
TCP	*lb.*	.33 /	.36
Naugatuck decylbutyl phthalate	*lb.*	.29 /	.30
Dibutyl phthalate	*lb.*	.30 /	.33
Sebacate	*lb.*	.645 /	.67
Diisooctyl adipate, dioctyl adipate	*lb.*	.425 /	.455
Diisooctyl phthalate, dioctyl phthalate, Isooctyl decyl phthalate	*lb.*	.305 /	.335
Dinonyl adipate	*lb.*	.445 /	.475
Dioctyl sebacate	*lb.*	.585 /	.61
Epoxy plasticizer	*lb.*	.335 /	.36
Tricresyl phosphate	*lb.*	.33 /	.36
Plastoflex MGB	*lb.*	.29 /	.37

Reichhold Chemicals, Inc., White Plains, N. Y., has announced completion of arrangements for a $10-million combination bank loan and debenture, the money to be used for long-range expansion and working capital. The company has been committed for the balance of the year on all basic chemicals, except phenol and pentaerythritol.

Hooker Electrochemical Co. and **Niagara Alkali Co.,** both of Niagara Falls, N. Y., are negotiating for a merger of the latter company into the Hooker organization by the issuance of one and six-tenths shares of Hooker common stock for each of the outstanding 600,000 shares of Niagara.

U. S. Industrial Chemicals Co., division of National Distillers Products Corp., New York, N. Y., has announced the opening of two new warehousing points for Petrothene polyethylene resins at Cincinnati, O., and New Orleans, La. This brings the number of distribution points throughout the country to five.

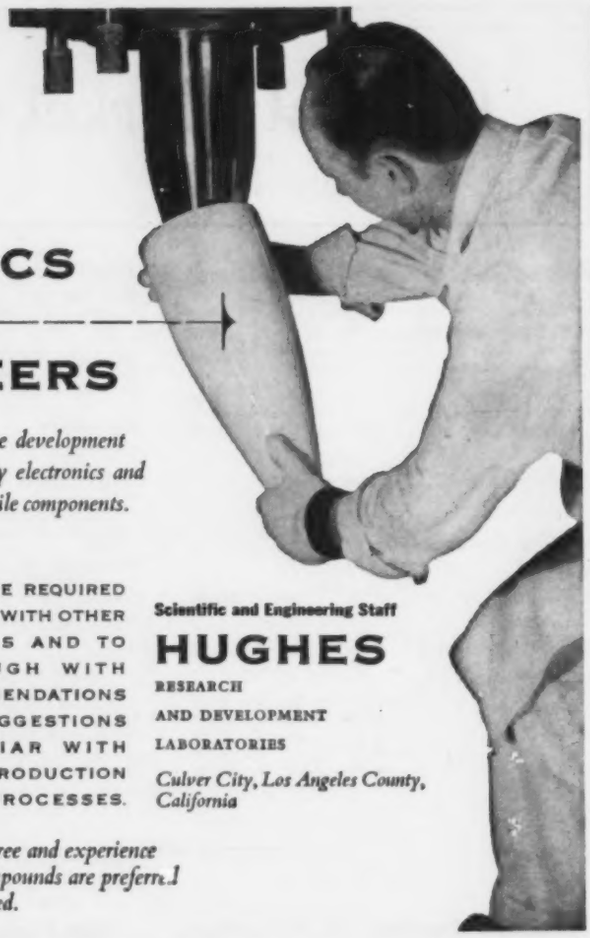
Synthane Corp., Oaks, Pa., was awarded the Pennsylvania Manufacturers Association's safety plaque for achieving 1,640,436 continuous man-hours of production without a single lost-time accident during the period from April 2, 1954 to June 1, 1955.

Argus Chemical Corp., Brooklyn, N. Y., has appointed H. M. Royal, Inc., Los Angeles, Calif., as sales agent for their plastics stabilizers and plasticizers in California, Utah, and Oregon.

Acheson Dispersed Pigments Co., Philadelphia, Pa., has announced the election of Howard A. Acheson, John P. Deringer, Raymond Szymanowitz, John C. Sprague, and John S. Thome to the board of directors. At a subsequent directors' meeting, the following officers were elected: Mr. Acheson, president; John S. Thome, vice president; Mr. Sprague, secretary-treasurer; and Nicholas J. Caggiano, assistant secretary and assistant treasurer.

Reed-Prentice Corp., Worcester, Mass., has announced the opening of branch sales offices in Buffalo, N. Y., and Los Angeles, Calif. Respective locations are 2 Lockwood Lane, Orchard Park, N. Y., and 1213 North Highland Ave., Los Angeles.

The Eagle-Picher Co., Cincinnati 1, O., recently purchased for cash the assets of Wilson & Hoppe Plastics, Whittier, Calif., manufacturer of laminated plastic products, whose operations now are being conducted by Eagle-Picher's Fabricon Products Division. Expansion plans include products to supplement present lines, as well as new items to increase and diversify the company's output.



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CALENDAR of COMING EVENTS

September 28
Reinforced Plastics Group, SPE New York Section, Tufaro's Restaurant, Corona, N. Y.

September 29
Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

October 4
SPE Southern California Section, Scully's Restaurant, Los Angeles, Calif.

October 5-8
World Plastics Fair & Trade Exposition, National Guard Armory, Los Angeles, Calif.

October 7
Detroit Rubber & Plastics Group

October 10
SPE Cleveland-Akron Section, Spanish Tavern, Brecksville, O.

October 13, 14
SPI New England Section, Equinox House, Manchester, Vt.

October 19
SPE New York Section, Gotham Hotel, New York City

October 26
Reinforced Plastics Group, SPE New York Section, Tufaro's Restaurant, Corona, N. Y.

November 14-15
TAPPI National Plastics Meeting, Brooklyn, N. Y.

November 16
SPE New York Section, One-day symposium, "Plastics for Packaging"

December 6, 7
SPI Film, Sheeting, and Coated Fabrics Divisional Conference, Hotel Commodore, New York, N. Y.